AUGUST
1946

Public Works

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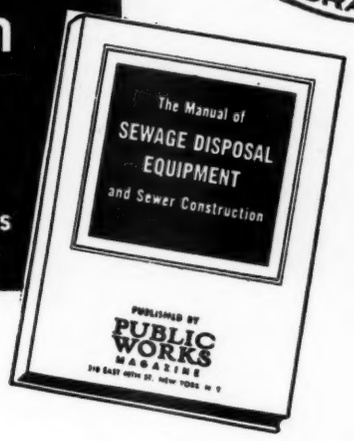
A Test for Sewer Tightness

Removing More Snow with Fewer Plows

How to Apply Copper Sulphate

"A GREAT HELP in Working Up Data on Sewage Disposal"

Say Leading Sanitary Engineers



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Formerly The Manual of Sewage Disposal Equipment and Sewer Construction.

More than 700 Sanitary Engineers have written to tell us how useful they find the Manual in their work. It is the only complete source of information about *every* type of product that can be used for sewage treatment or sewer construction.

Engineers find it insures them against overlooking any product they might use when preparing plans. They use it in office discussions leading up to the final choice of equipment. Many say it is a great help in explaining to non-technical officials how the equipment works.

The Sewerage Manual is a year 'round exhibit—the all-year showplace of equipment and materials. Its editorial matter is specially written to help you understand the different types of equipment. A. Prescott Folwell, noted authority on sanitary engineering, revises and brings it up to date annually. Practically all the leading manufacturers tell the advantages of their products in its advertising pages. If you don't have this valuable Manual on your desk, write today and ask how to get one. Published by PUBLIC WORKS Magazine, 310 East 45th St., New York 17, N. Y.

YOU ALWAYS FIND IT IN *The Manual*

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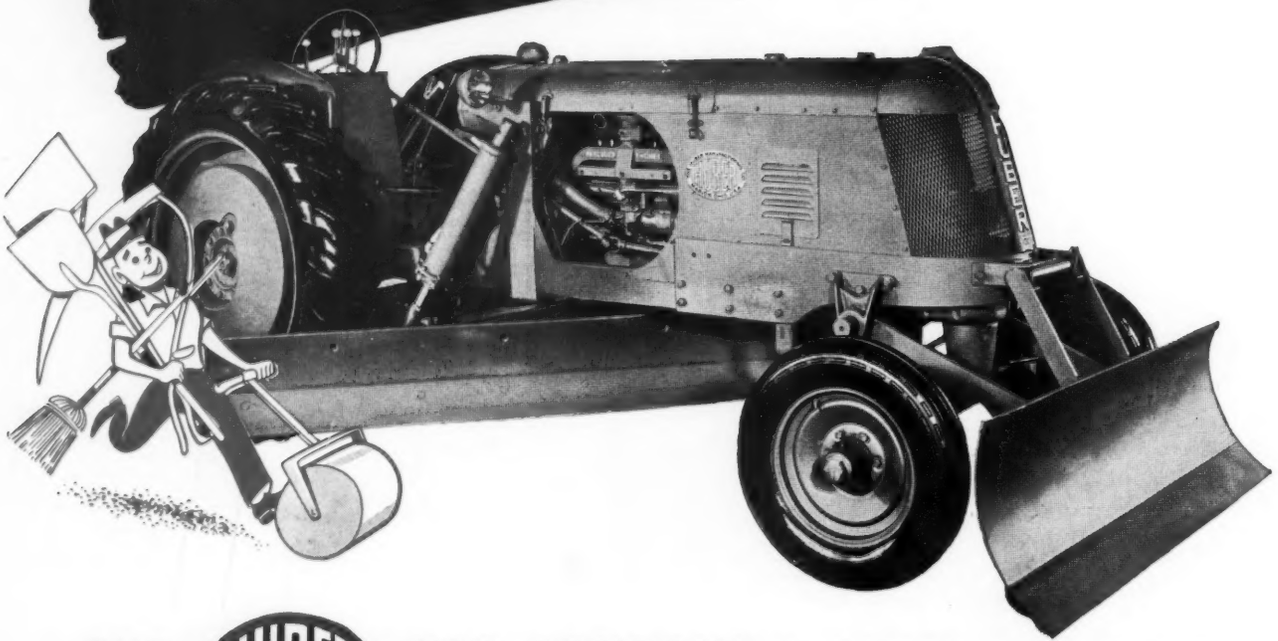

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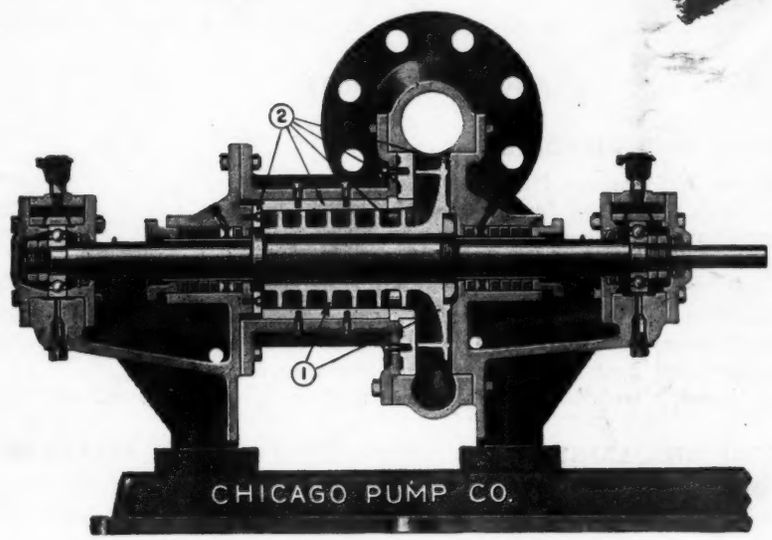
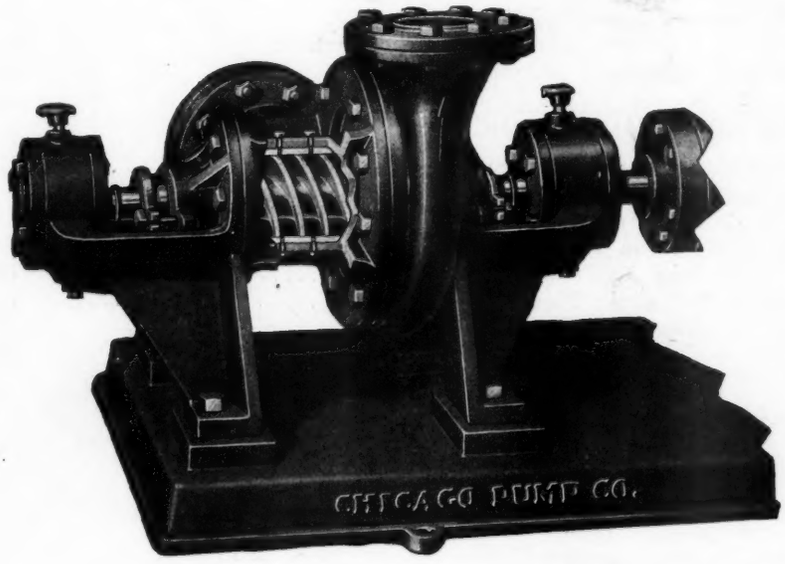


1—Screw feed and impeller. 2—Cutting edges.



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AUGUST, 1946

what designed strength can mean to your tunnel liner jobs

Rear view of weighing hopper. This elliptical batching tunnel of No. 10 gage Armco Steel is 11 by 13 feet and 460 feet long. Raw aggregates were stored over a 10-foot tunnel, 260 feet long, and wet sand over an 8-foot tunnel, 190 feet long.

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PUBLIC WORKS

Founded in 1896

Devoted to the interests of the engineers and technical officials of cities, counties and states

Vol. 77 No. 8

W. A. HARDENBERGH and A. PRESCOTT FOLWELL
Editors

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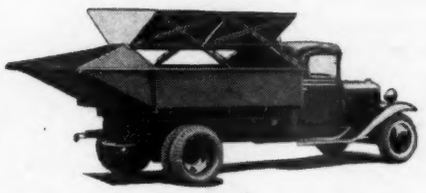
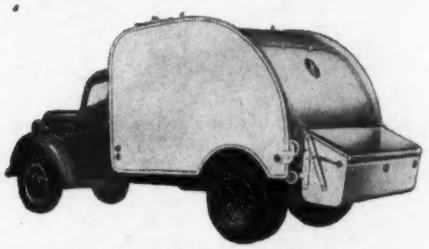
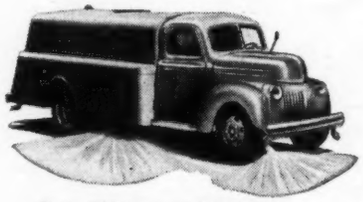
The Load Packer (patented) all enclosed garbage and refuse unit. Compresses loads hydraulically for maximum payloads.



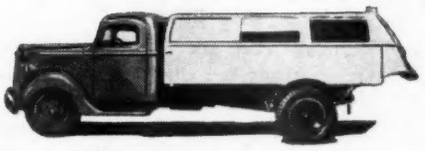
Type C28 scow end Garbage Body. Steel hinged covers extra equipment.



The new Bucket Loader, an all enclosed sanitary refuse disposal unit.



Street Flushers and Sprinklers.



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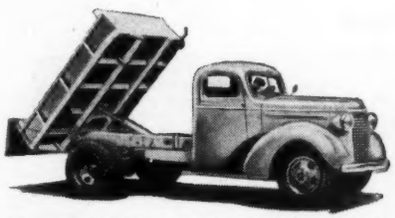

Type C12 Body and Model D6 or D7 Hoist. Dumping angle 55°.

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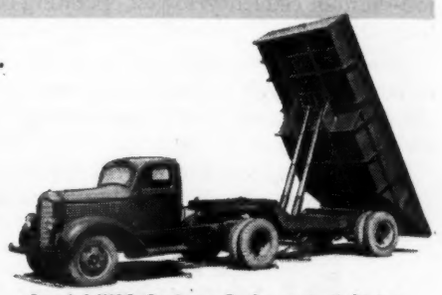

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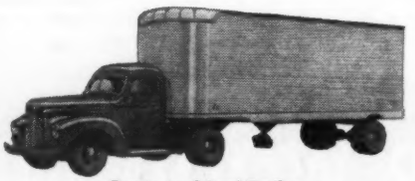

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When you need special information—consult the classified **READER'S SERVICE DEPT.**, *pages 67-69*

The Editor's Page

The Airplane, the Automobile and Public Works

The automobile was not only the prime and moving factor in our good roads program, but it was also the biggest single factor in increasing sales of water main and sewer pipe. Without the widespread use of the motor car, there would not now be the hundreds of thousands of miles of surfaced roads that reach every hamlet in the nation. This is well understood, but the part that the automobile played in water and sewer pipe sales is not so well appreciated. It created new markets for these products because it both displaced and dispersed city dwellers, moving them out into the country. The pipe used was smaller—4-inch, 6-inch and 8-inch, for the most part—but more footage was needed to serve the sparsely populated suburban areas.

It is practically certain that the airplane will do this all over again, moving our population still farther out. This will be accomplished through the medium of some three thousand new airports, small airports, many for private flying. Not only will every one of these sooner or later need water and sewerage service, and paved strips and access roads, but the areas they serve will grow in population just as every other area that is served with adequate transportation facilities has grown.

In these days of progress, it is pretty hard to take anything for granted. Just as soon as one does that he finds that things have moved on ahead of him. To the ground-minded, all this sounds like a pipe dream; but it isn't. So let's go.

In-Service Training Programs for Municipal Personnel

More than twenty years ago, this writer organized an in-service training program in Birmingham, devoting to it two hours each Saturday morning. These two hours returned the biggest dividends to the city of any similar time spent by the employees taking this course. The returns included increased technical knowledge and efficiency, morale and understanding of the work.

In the September issue of this magazine an outline for an in-service training course for sewer department and sewage treatment plant personnel will be published. This will be built around eight major and about eighty minor headings. Under each of these will be a paragraph summarizing good practice, and citing references to the subject in standard textbooks. Whenever possible, suggestions for practical demonstrations for use with the lectures will be given. Since this will be one of the first such programs worked out for this group, it is expected that it will be susceptible of much improvement under actual trial; but it will be a start, and a start has to be made to meet a need that has existed for a long time.

In later issues, as additional outlines can be prepared by competent personnel, similar in-service training courses will be prepared for water department and for highway and street department employees.

It is realized that such training cannot take the place of formal schooling, but it can increase the efficiency of the workers, reward those who are willing to learn, foster morale and decrease personnel turnover; and in doing these things, in-service training will inevitably return a big profit to our communities.

Our Increasing Knowledge of the Essentiality of Chlorination

The inactivation of poliomyelitis virus by relatively moderate amounts of free chlorine is reported in a recent issue of the *American Journal of Public Health*. A free chlorine residual in the neighborhood of two-tenths part per million seems to be sufficient. On the basis of previous experiments, when only orthotolidine chlorine was measured, it was thought that the virus was so resistant to chlorine that it would not be affected by practicable residuals.

Hepatitis virus has also been demonstrated by the sound work of Major Baty to be vulnerable to reasonable residuals. A great deal of work has been done on the effects of chlorine on amebic cysts, but none of this, it is believed, has utilized free available chlorine measurements, such as the OTA test. The extensive work already done on this subject should be supplemented in the light of our more recent knowledge of chlorination.

Evidence continues to pile up that adequate, effective and continuous chlorination is one of our most effective health safeguards. Certainly our war experience showed this, for chlorine was applied at least adequately and certainly effectively. No one can doubt that this policy contributed greatly to the marvelous health record of the American Army.

We must not forget that effective chlorination depends to an extent perhaps unrealized by many on adequate preparation of the water before chlorination, and on skilled and conscientious application of chlorine.

Headaches and Struggles We Can Afford; Contentment Never

"More than frequently I hear someone refer to this or that machine as future standard equipment. This is dangerous thinking. The minute we regard any machine ever made as other than obsolescent, our future is in jeopardy. Headaches and struggles we can afford; contentment never."

Substitute "airplane" for "machine" in the above and the quotation is from Gill Robb Wilson's column in the *New York Herald Tribune*. What he says is just as true for highway, sewerage and water works equipment as for airplanes. Getting along with outmoded tools is too often a failing of engineers. They use their natural ability and their technical training to do this very thing of getting along without all the better; and too often they only *think* they are saving money when actually they are blocking progress and development.

Some people think that leadership training has been neglected in our engineering schools; maybe so, maybe not, but a new and bolder concept of the place that engineers can take in public life is needed, along with the courage to step forward and take that place.

We won't bore you WITH all THE ADVANTAGES OF FLEXIBLE—BUT...

There have to be some mighty good reasons why 78% of the nation's cities equip their Sewer Departments with Flexible Sewer Rods.

FLEXIBLES PAY FOR THEMSELVES. Flexibles will actually pay for themselves five times each year because three men can clean more pipe in a day with Flexible Equipment than an entire crew working with old style equipment.

FLEXIBLES ELIMINATE UNSANITARY WORK. Dig-ups are seldom necessary when Flexibles are used. Men work at street level through manholes and eliminate that hot, unsanitary part of the job. There is a Sewer Rod tool to handle any pipe cleaning job.

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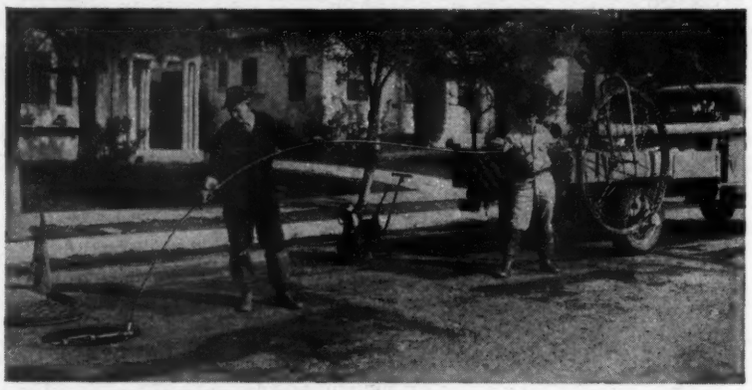

Flexibles permit men to work effectively at street level. Workman is shown placing the Flexible tool in the line through a manhole with the aid of a rod guide.

When corkscrew reaches obstruction, rod is disconnected from reel. Flexible Power Drive is then connected to turn corkscrew into obstruction.

Flexible Power Drive turns rod at speed 5 times faster than that possible by hand turning.

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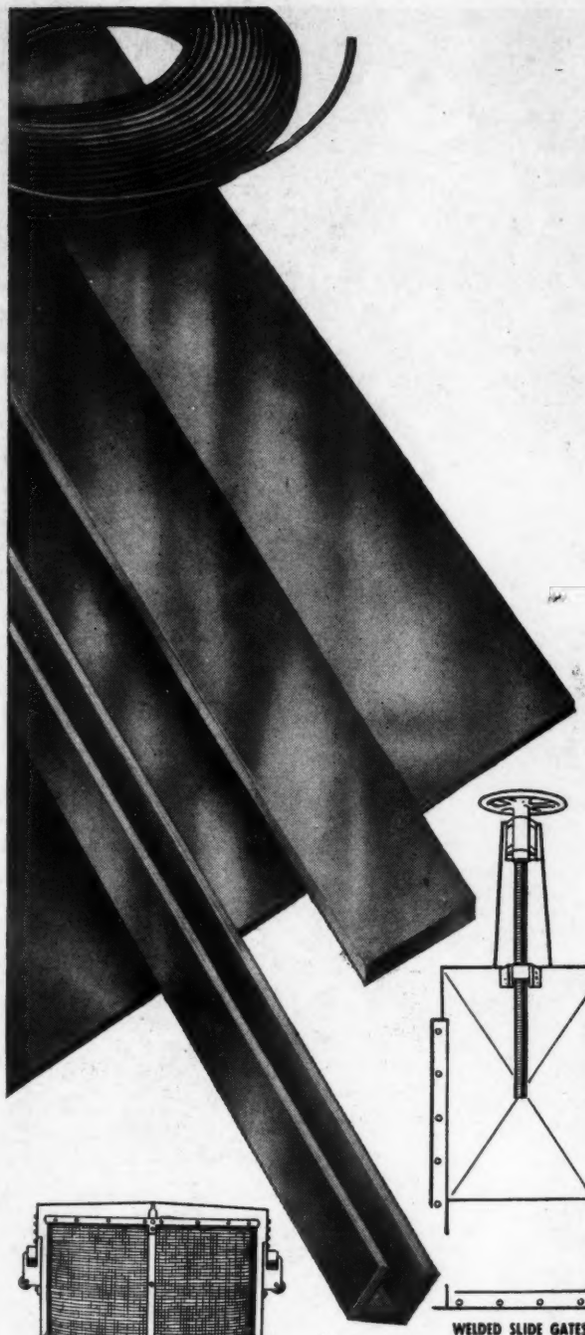

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Proof of the economical long life provided by Everdur may be found in many waterworks and sewage plants throughout the country . . . where 19-year-old installations are still in service. The American Brass Company does not manufacture equipment, but supplies Everdur Alloys in commercial forms to leading fabricators. Write for Publications E-11 and E-6. 46215

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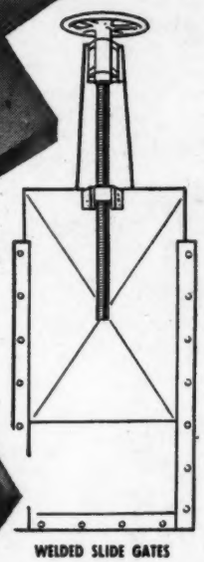
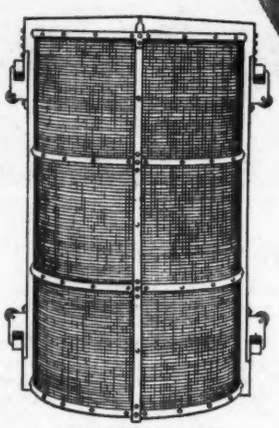
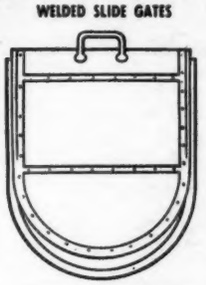


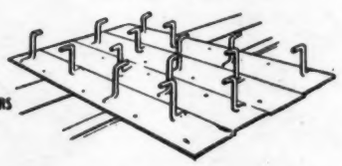
WELDED SLIDE GATES



SCREEN WIRE AND FRAMES



ADJUSTABLE OUTLET WEIR



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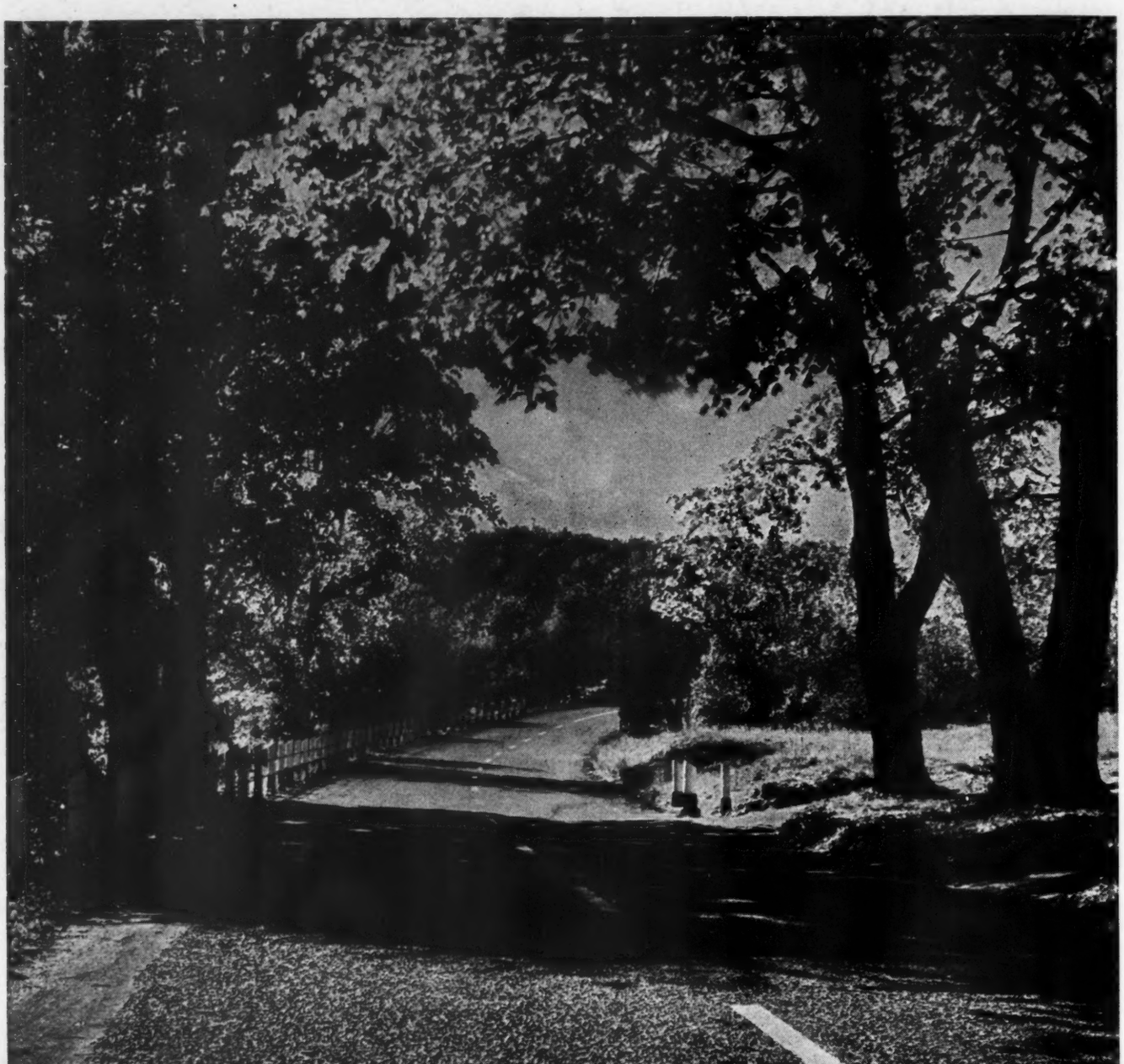

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It's the kind of road that motorists like to travel on a Sunday afternoon. It's quiet . . . and pretty . . . and agreeably free of traffic.

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Unfortunately, not all of this vital farm-to-market network is as well paved as the road above. More than half is still unsurfaced, and over one-third is still classed as "primitive."

In the work that remains to be done, Barrett Tarvia* road tar will have an increasingly important part. The combination of Tarvia, local materials and local labor enables almost any community to build modern all-weather roads quickly and at low cost.

Why not discuss your own secondary road problems with the Tarvia field man?

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When you need special information—consult the classified READER'S SERVICE DEPT., *pages 67-69*

This International TD-18 Diesel Crawler Tractor and revolving crane was purchased two years ago by an electric and water department. As the result of its use, accidents have been eliminated in the pole and pipe yards.

The foreman in charge says that savings realized would pay for both crane and tractor in the first five years of use! Previously a crew with cant hooks was used for this work.

Poles vary from 35 to 65 feet in length. The crane has a 30-foot boom and handles the poles and heavy cast iron pipe easily.

It will pay to consult the International Industrial Power Distributor near you before buying tractors and equipment for your operations. Long-lived, instant-starting International Diesel Tractors and Power Units can relieve you of many a tough, man-killing job.

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INTERNATIONAL HARVESTER COMPANY
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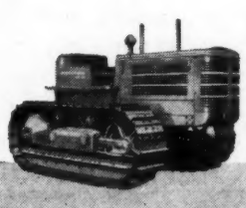
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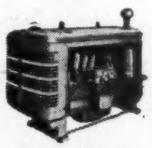
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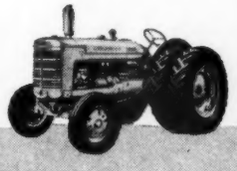
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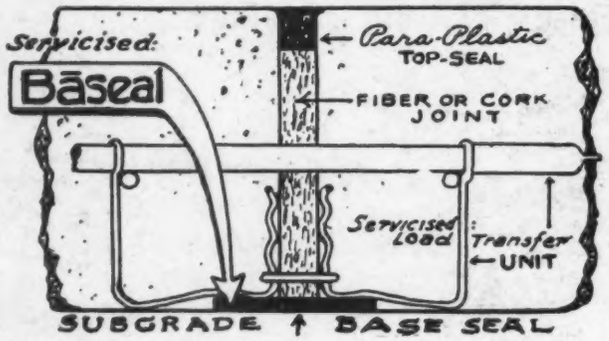

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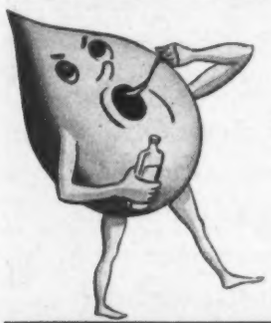

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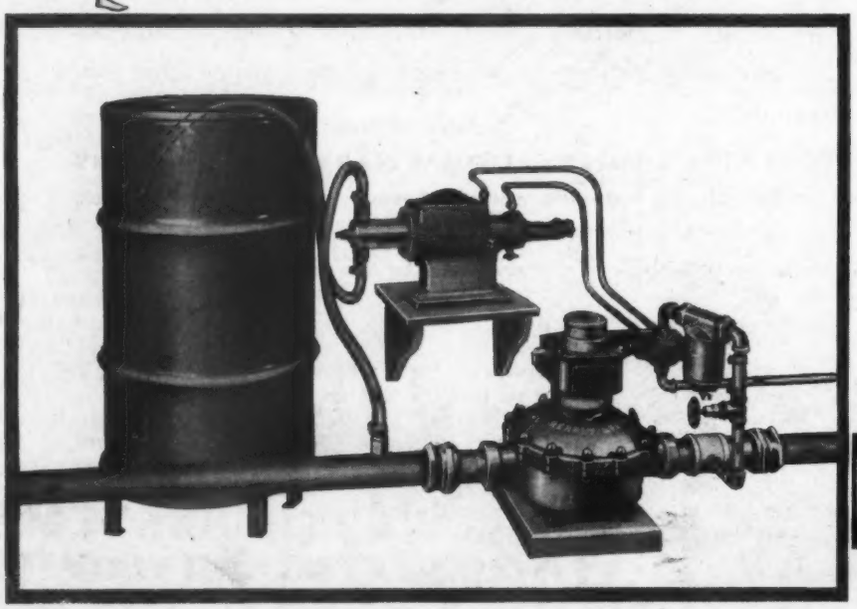

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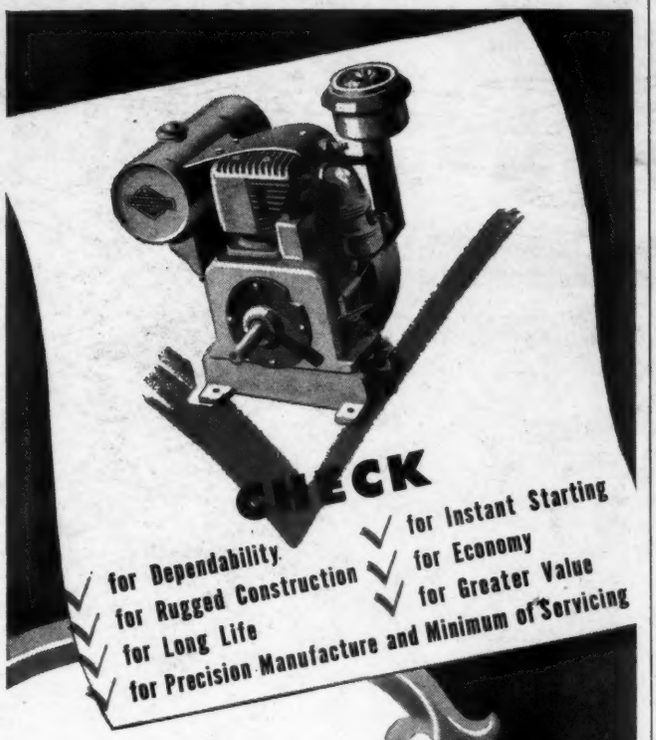

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Behind Layne Well Water Systems are seventy years of engineering research and practical experience. These Systems embody basic Layne developed and patented features which cannot be duplicated by others. Such exclusive and thoroughly proven superiority has made the name Layne world famous.

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With Transite, you can select the minimum pipe size from the start—without allowance for reduced carrying capacity due to tuberculation. For Transite's initial high flow coefficient (C-140) can never be reduced by this costly form of internal corrosion.

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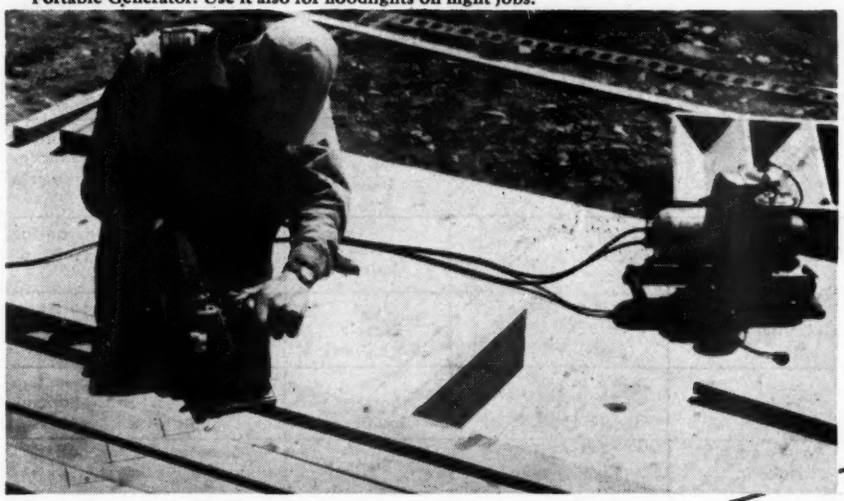
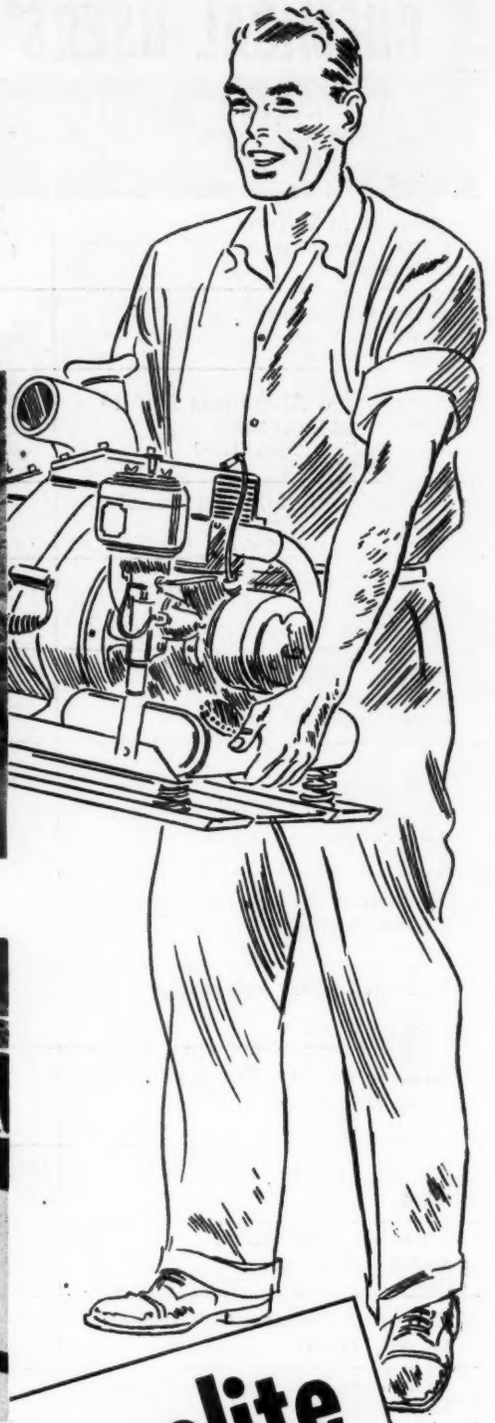
Below — Operate electric tools . . . saws, grinders, drills and many others . . . with a Homelite Portable Generator. Use it also for floodlights on night jobs.





Do you want to see these pictures come to life? Do you want to see how you, like thousands of others, can cut operation costs . . . get more work done in less time . . . with Homelite Portable Gasoline-Engine-Driven Pumps and Generators?

Then write, *now,* and ask us to have a Homelite Representative arrange to give you a free demonstration. Without obligation to you in any way, he'll show you, *right on your job,* Homelite Portable Pumps and Generators *in action.* You ask him questions. Run the units yourself. You can find out everything you want to know about their design and operation. You can see, for yourself, just what you can expect in on-the-job performance. Write today.

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CHEMICAL USERS' GUIDE To General Chemical Company Products for Treatment of Water, Sewage, and Industrial Wastes

PRODUCT	AVAILABLE FORMS	COMMERCIAL STRENGTH (MIN.)	SHIPPING CONTAINERS	APPLICATIONS
Aluminum Sulfate $Al_2(SO_4)_3 \cdot 14H_2O$ approx. *(Filter Alum)*	Commercial & Iron Free: Lump • Ground Powdered	17.25% Al_2O_3	Bags Barrels • Drums Bulk Carloads	Coagulant for water and sewage. Dewatering conditioner for sewage sludge. 1% Sol. pH 3.4.
Aqua Ammonia NH_4OH plus Water *(Ammonia Water)*	Colorless Liquid	26°Be. (29.4% NH_3)	Steel Drums Carboys	Used with chlorine to form chloramines for water disinfection.
Ammonium Aluminum Sulfate $Al_2(SO_4)_3 \cdot (NH_4)_2SO_4 \cdot 24H_2O$ *(Ammonia Alum) (Crystal Alum)*	Lump Nut Granular Powdered	11.2% Al_2O_3	Bags Fibre Drums	Coagulant for water. Advantageous for pressure filters. Supplies ammonia for chloramine formation. 1% Sol. pH 3.5.
Sodium Bisulfite, Anhydrous $Na_2S_2O_5$ *(ABS) (Sodium Metabisulfite)*	Powdered	97.5% $Na_2S_2O_5$ (Equiv. 65.5% SO_2)	Fibre Drums	Antichlor. Remove iron and manganese deposits from filter sand. 1% Sol. pH 4.6.
Sodium Silicate $Na_2O \cdot X(SiO_2)$ plus H_2O *(Water Glass) (Silicate of Soda)*	Viscous Liquid	38° to 52°Be. Various Ratios of $Na_2O:SiO_2$	Drums Tank Cars Tank Trucks	1. Aid in floc formation. 2. Prevent red water corrosion in distribution lines. 1% Sol. pH 12.7
Sodium Thiosulfate $Na_2S_2O_3 \cdot 5H_2O$ *(Hypo) (Sodium Hyposulfite)*	Crystals: Prismatic Rice Selected Universal Granular	99.75% $Na_2S_2O_3 \cdot 5H_2O$	Bags Barrels Fibre Drums	Antichlor. Water solution is neutral.
Sulfuric Acid H_2SO_4 plus H_2O *(Oil of Vitriol)*	Corrosive, oily liquid Various strengths	66°Be. (93.19% H_2SO_4)	Bottles Carboys Drums Tank Trucks Tank Cars	1. Reduce pH and alkalinity. 2. Regenerate carbaceous zeolites and ion exchangers. 3. Activate Baylis Silicate.
Potassium Aluminum Sulfate $Al_2(SO_4)_3 \cdot K_2SO_4 \cdot 24H_2O$ *(Potash Alum)*	Lump Nut Granular Powdered	10.7% Al_2O_3	Bags Fibre Drums	Coagulant for water. Slow, even rate of solubility desirable for solution pot feeders. 1% Sol. pH 3.52.
Sodium Sulfite, Anhydrous Na_2SO_3 *("Sulfite")*	Granular Powdered	98.5% Na_2SO_3	Bags Fibre Drums	Antichlor, oxygen remover. Weak solutions absorb oxygen readily. 1% Sol. pH 9.8.
Sodium Sulfate, Crystal $Na_2SO_4 \cdot 10H_2O$ *(Glauber's Salt)*	Crystal & Needle Crystal	96% $Na_2SO_4 \cdot 10H_2O$	Barrels Bags Drums	Neutral Solution. Boiler water treatment (maintenance of sulfate-carbonate ratio).
Sodium Sulfate, Anhydrous Na_2SO_4	Powdered	99.5% Na_2SO_4	Bags Barrels	Neutral Solution. Boiler water treatment (sulfate-carbonate ratio)
Trisodium Phosphate $Na_3PO_4 \cdot 12H_2O$ *(TSP)*	Crystal	98.5—103% $Na_3PO_4 \cdot 12H_2O$ (Equiv. 19% P_2O_5)	Bags Barrels Fibre Drums	Boiler water treatment. Cleaning compound. 1% Sol. pH 11.8-12.0.
Disodium Phosphate, Crystal $Na_2HPO_4 \cdot 12H_2O$	Crystal	98% $Na_2HPO_4 \cdot 12H_2O$ (Equiv. 19.5% P_2O_5)	Bags Barrels Fibre Drums	Boiler water. (Calcium and magnesium precipitation.) 1% Sol. pH 8.4.
Disodium Phosphate, Anhydrous Na_2HPO_4	Powdered Flake	96% Na_2HPO_4 (Equiv. 48% P_2O_5)	Same	Same as Crystal, but stronger product.
Sodium Fluoride NaF *(Fluoride)*	Powdered (white or blue colored: Nile Blue) Light or dense	90% and 95% NaF	Bags Barrels Fibre Drums	Fluorination of water supplies. (For information, consult with local health officers.)

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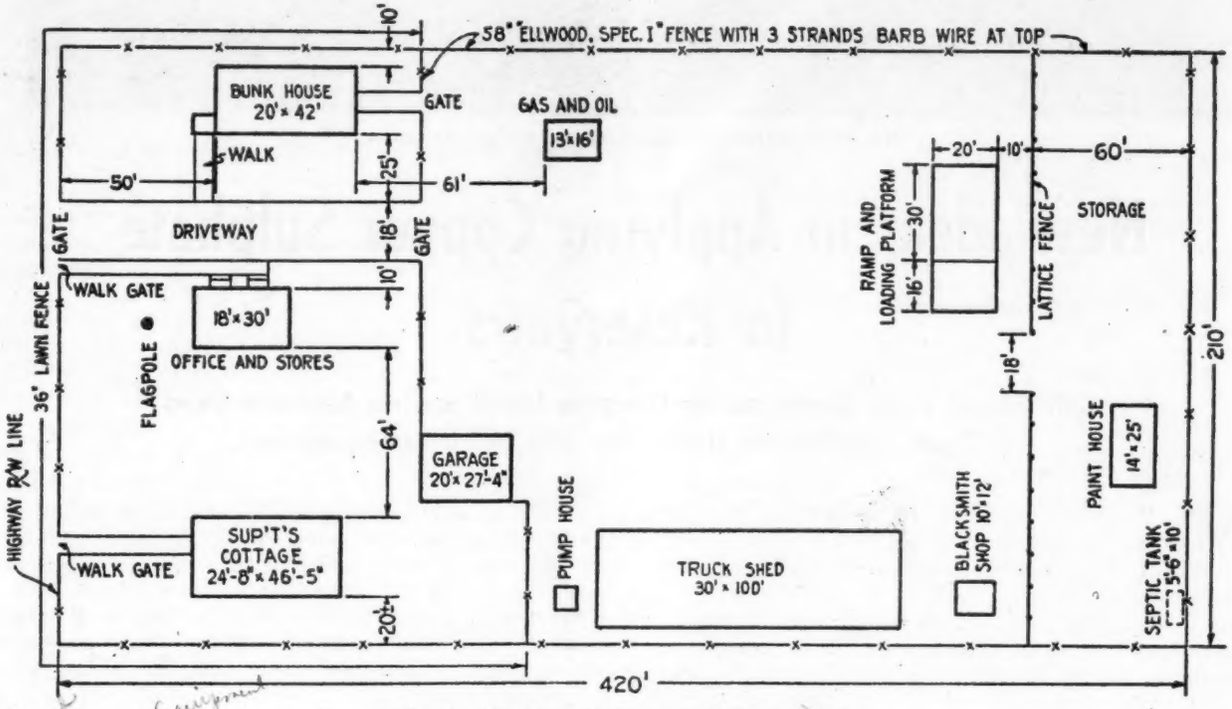
PUBLIC WORKS MAGAZINE . . . August, 1946

VOL. 77. NO. 8



California plan for a highway maintenance station.

Building Road
xx Maintenance Road-Equipment

Highway Maintenance Station Plan and Operating Rules

The accompanying plan for a maintenance station layout is taken from the Instruction Manual of the Maintenance Department of the Division of Highways of California. With slight modifications, this layout could be used for a county highway department headquarters. Particular attention should be given to the source of water supply; in fact, it is desirable that the Sanitary Engineering Division of the State Board of Health advise on both the water supply and the method of waste disposal. The location of the septic tank, shown in the layout in the remote corner of the property, is not generally desirable; it is better to put it well within the lot, so there will be ample space on the property for subsurface disposal.

Buildings should usually be placed at least 25 ft. apart for fire protection. Water standpipes of the frost-proof type should be placed at convenient locations outside the buildings. Foam type fire extinguishers should be placed just inside the front door of each building, where they will be readily available in case of need. Lawn and shrubbery planting is desirable.

In California, when a cottage is provided, as shown in the layout, for the superintendent, caretaker or foreman, a monthly rental is charged which is based on a 4% annual depreciation rate of the cottage, plus a "reasonable amount" for utilities, water and upkeep furnished by the state. These charges will depend on local conditions.

Special consideration should be given to the selection of the site so that it will serve the territory tributary to it efficiently. The area should be not less than 2 acres.

The Texas Highway Department requires that no material shall be piled next to warehouse or maintenance station fences; an 8-ft. space should be left between the fence and the material to permit cleaning of grass and weeds, which may constitute a fire hazard, and to permit a driveway for trucks in case of emergency. The same rule should apply as well to buildings as to fences. Texas also requires fencing 6 ft. high, made either of undamaged wire mesh guard fence salvaged from the highway, with salvaged 2-inch galvanized iron pipes set in concrete, or of wood pickets.

This shows the excellent distribution of the dust at Liberty.

New Ideas in Applying Copper Sulphate to Reservoirs

Officials of Three Communities Describe Labor Saving Methods Used by Them; Application Under Ice; Use of Power Equipment.

METHODS of applying copper sulphate to reservoirs, as described by water works officials of three New York state communities were described in the second quarterly issue of the *Water Works News,* which is published by the New York State Department of Health. Copper sulphate is used for the suppression of algae growths. Four forms of the material are available: Lump crystals, commonly known as bluestone; granular; snow or fine granular; and powder. Actually, a fifth form is available, which has a somewhat higher copper content and costs considerably more. This is monohydrate copper sulphate, which, like the powdered form, is suitable for use with the blowers described below.

Most algae and other microorganisms which impart tastes and odors to potable water supplies grow in shallow areas or in the upper 20 to 30 feet of deep reservoirs. In fact many troublesome organisms are in the upper 10 feet of the water where sunlight is strongest. Therefore, better results frequently can be secured by using a powdered form of copper sulphate to destroy organisms near the surface, whereas the "snow" or granular size of the material gives better results when deeper-lying organisms are being suppressed because the larger granules sink into the water for an appreciable distance before dissolving. It is possible to develop a rather precise procedure in coordinating the size of the granules to the depth of the water containing the organisms being destroyed. This refinement, however, necessitates the grading of the copper sulphate as to size, or the purchase of a supply of each size, and also the microscopic examination of samples of water collected at various depths.

Copper Sulphate Treatment at Skaneateles Lake

Elon P. Stewart, Division-Engineer—Water, Syracuse, N. Y.

The city of Syracuse has been treating Skaneateles Lake, the source of its water supply, with copper sulphate crystals since 1926 in order to eliminate objectionable tastes and odors caused by algae.

Prior to 1938, the method used was to place the crystals in burlap bags and drag these through the water by means of a motor boat. Objection to this method was raised by the fishermen, the claim being made that small fish were killed in areas where the copper sulphate was in concentrated solution. It was decided, therefore, to develop a type of treatment which would reduce the concentrations enough to correct this condition.

Special equipment for this purpose was designed and built by the Water Division personnel. Following is a brief description of it: Copper sulphate is put into a hopper located at the top of the apparatus. From the hopper it is fed into a small tank or dissolving chamber over an electrically rotated drum. By varying the speed of rotation, the number of pounds of copper sulphate fed per minute can be regulated within desirable limits. Current for the motor operating the drum is supplied by the storage battery of the engine of the motor boat in which the equipment is installed.

Water is taken from the lake by means of a low head centrifugal pump driven directly from the motor boat engine. It passes through the copper sulphate crystals and dissolves them, forming a concentrated solution. The solution is conveyed by a high pressure gear pump from the bottom of the dissolving chamber through hose to the spray nozzles which are located on out-riggers attached to the stern of the boat. As both the low pressure and the high pressure pumps are driven directly by the motor boat engine, there is a fixed relation between the speed of the boat and the rate of pumping. This fact, coupled with the variable speed of the feed drum, gives ample control of the rate of dosage.

This equipment lays down a spray of copper sulphate solution over an area about 40 to 50 feet wide. In applying the copper sulphate, the boat is directed in parallel courses across the lake, the direction depending to a great extent on the wind prevailing at the time of treatment. These parallel courses are about 700 feet apart. Wind action is depended upon to distribute the copper sulphate solution between areas of application. It is estimated that the greatest concentra-

tion of copper sulphate at any point in the lake is one part per million.

The entire lake is about 15 miles long with an average width of three-quarters of a mile. It can be treated with 11 tons of copper sulphate in about 16 hours of operation. The boat used for this purpose is 25 feet long with a beam of about 8 feet. The speed of the boat is 8 to 10 miles an hour.

This method of treatment has been found to be very satisfactory both from the standpoint of efficiency of application and of elimination of areas of high concentration of copper sulphate. There have been no complaints from the fishermen since this method was started.

Boat and application at Newburgh.

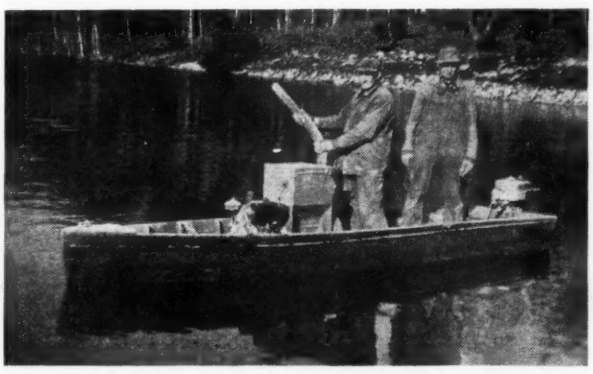
Copper Sulphate Treatment at Liberty, New York

By Joseph Griebel, Supt. of Water

Copper sulphate has been added to the Liberty water supply for years by being dragged in bags behind rowboats. Shallow areas of the reservoir could not be reached. Manufacturers of copper sulphate suggested the use of monohydrated copper sulphate as a powder for use with a duster or blower. The duster, costing $178, was placed in the center of a 14 foot outboard motor boat. A fine cloud of dust is sprayed over the water as the boat proceeds. The dust can be driven several hundred feet which permits its application to shallow areas beyond the reach of the boat. Some of the dust is distributed over the shoreline of the reservoir so that it is washed into the reservoir later when it rains.

The monohydrated copper sulphate does not become lumpy in storage if it is stored in a dry place in the tight paper bags furnished for the purpose.

During the winter of 1941 there was a very bad taste in the Liberty water supply due to algae growth. Sanitary engineers advised cutting holes 25 to 50 feet apart and lowering sulphate bags through the holes. This process took much time and the cost was high, so I made a frame from three 2 x 6's, one being 2 feet long and two 6 feet long. These were placed upright and nailed together in the form of a triangle. I fastened the outboard motor on the short crosspiece and hung a bag of sulphate crystals in back of the motor. When the motor was started the force of the propeller stream against the bag of copper sulphate distributed the solution a distance of approximately 500 feet. The force was naturally parallel with the propeller stream and to make a complete circle it was necessary to turn the apparatus completely around very slowly. During this operation the motor must be run at top speed. An extension for the propeller shaft must be available to permit the propeller being lowered beneath the ice. By this method it is only necessary to cut holes approximately every 1000 feet and I find it nearly as satisfactory as summer application of copper sulphate.



The Liberty equipment ready to go.

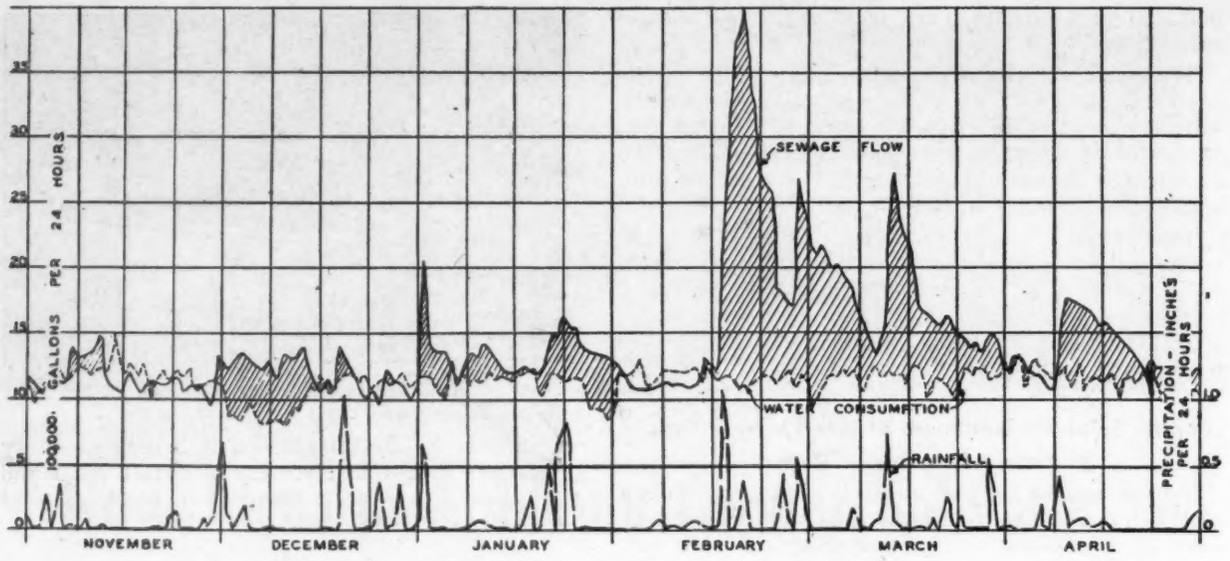
Copper Sulphate Treatment at Newburgh, N. Y.

John Kingsley, Chief Chemist, Bureau of Water

Application of copper sulphate to Washington Lake for the control of microorganisms (algae) is made by scattering dry crystals over the surface of the water rather than by dragging bags of large crystals through the water behind row boats. This method utilizes a gasoline driven blower. The blower is fed by a hopper which permits adjustment of the amount of chemical fed to the blower. The blower and engine are mounted in a large flat bottom skiff powered by a 16 H.P. outboard motor. A crew of three man the craft. One crew member tends the outboard and the steering. Two others keep the blower hopper full from the "cargo" of 100 pound bags of copper sulphate. The blower discharge is carried aft and out over the stern of the boat.

The dose of copper sulphate desired for any particular organism is regulated by a combination of boat speed, rate of chemical delivery to the blower and size of copper sulphate crystal used. Two sizes of crystal are found convenient. These are known as "fines" (snow) and a coarser grade, designated by the suppliers as "granular." For light doses and for treating only the upper few feet of water as for the destruction of *Anabaena,* maximum boat speed, minimum hopper discharge and "snow" copper sulphate is the combination used. When a heavier dose and treatment to some depth is required, the following combination proves successful: Slow boat speed, more rapid chemical feed to the blower and the use of the "granular" grade of chemical. To pre-determine the depth to which treatment is to be carried, depth samples for microscopic examination are collected.

Experience with this method at Newburgh has indicated that it is thoroughly effective and possesses several advantages over the bag dragging method. First there is a saving of 50 per cent of copper sulphate. This saving probably accrues from the better distribution of the chemical and the speed of application. Again, three men accomplish in a few hours what formerly required eight men working six to eight hours. A third advantage is that the laborious and dull work of towing bags of copper sulphate for long tedious hours is eliminated. This latter fact, making as it does for better labor-management relations, is not the least advantage of this method of copper sulphate application to reservoirs.



Relation of water consumption, sewage flow and rainfall in Princeton.

A Sewer Test for Tightness

An Experiment to Determine the Internal Pressure That Bituminous Joints for Vitrified Clay Sewer Pipe Will Stand

By I. RUSSELL RIKER, C. E.
Engineer for Princeton, N. J.

SEWERS were first installed in Princeton Borough in 1882. In 1915, the records indicated there were thirty-three miles of sewer completed, nearly all of the pipe with cement joints. Today there are 55.5 miles of lateral and trunk sewer divided as follows: 6"—5.8 miles; 8"—31.8 miles; 10"—5.9 miles; 12"—0.8 miles; 15"—0.6 miles; 18"—2.6 miles; 24"—5.7 miles; and 30" and 36"—2.3 miles. There are 2,506 connections to dwellings, business places, and University buildings making an estimated total of nineteen miles of 4" and 5" pipe of which about fifteen miles have cement joints. Most of this pipe is clay, less than a mile being iron; more than half of the sewers have joints of doubtful tightness. Since 1932, there have been twelve miles of sewers installed and 284 house connections or approximately 2.5 miles of small pipe. These have all been made with bituminous joints and under careful inspection. A Sewer Ordinance passed in 1932 forbids cellar drains, roof drains, and footing drains to be connected to sanitary sewers. This ordinance has been strictly enforced; although, it was not retroactive.

Actual Infiltration

Due to the peculiar underground conditions in Princeton Borough and Princeton Township, infiltration into our sewers is several times the average, at certain times of the year. This period is usually in February, March, and April; although, December and January sometimes show high infiltration (see curve of sewage flow, rainfall and water consumption). There is naturally a direct relation between rainfall and infiltration; at times the sewage flow falls below water consumption. Infiltration also occurs occasionally in other months during the year when there has been a prolonged period of rainfall. The water table during these periods may only be a few feet below the surface of the ground so that the sewers are continually under pressure from the outside. Not more than 20% of the sewer is underdrained with gravity outlets.

Infiltration and Hydrostatic Tests

The conventional infiltration test is not satisfactory unless it is made during these wet periods. The contractor usually finishes his job in the summer or fall when the ground water is not very high and the ground surrounding the pipe may be dry. A fair infiltration test therefore can not be made. Usually, we cannot wait until the following early winter or spring before house connections are made and furthermore the contractor insists on having his work approved when completed. Besides this, an infiltration test is not satisfactory if the sewer is underdrained and while underdrains keep down infiltration one of the chief objections to them with gravity outlets is that the sewer may leak outward into the underdrain and thence pollute the streams.

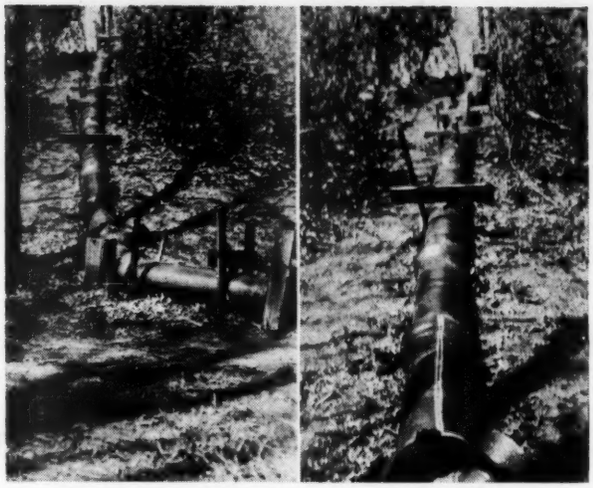
To overcome the difficulties of the conventional infiltration test we inaugurated several years ago a hydrostatic test of the sewers which consists of filling the pipe full of water and measuring the leakage out of the pipe instead of the normal method of measuring it into the pipe. If the work can be tested in the spring and conditions permit it, we naturally use the infiltration test but we give the contractor the choice of making a hydro-static test immediately upon completion of the work or upon completion of various sections, even to the extent of testing between manholes when severe grades and naturally high heads are encountered. This test, many contractors claim, is unreasonable. It is said that the pipe is never intended to be under pres-

sure and yet if a sanitary sewer clogs, even the upper end may be put under pressure equal to the depth of the manhole. All that we require is a pressure of one-tenth of a pound per square inch but naturally on lines 500 ft. long between manholes the static pressure at the lower end of the sewer may be as high as seven or eight pounds per square inch or even more, depending upon the grade of the sewer. Contractors maintain that gravity sewer lines will not stand this pressure. They further maintain that bituminous joints for the clay pipe will not stand up. Some engineers agree with them. Little actual data are available as to how much such joints will stand.

In view of this lack of information, we decided to run a test at our sewage treatment plant to determine how much pressure these joints would stand. A line of pipe about 36 feet long was laid on a bank as shown in the accompanying illustration, with three lengths along the bottom of the bank. The line was well braced and near the bottom a Y was located with a conventional stopper. The bell of the Y was filled in with bituminous material; ordinary bituminous joint compound was used, and the joints were made in the conventional manner. A small amout of oakum was first inserted in the bell and then it was entirely filled with plenty of bituminous material. The pipes were products of several manufacturers.

Results of Tests of Pipe Under High Pressure

The first test consisted of filling the line with water so that the lower section was under a gravity pressure equal to 22 feet head. All joints stood up satisfactorily and showed no signs of leaks. Both ends of the pipe were then plugged with regulation adjustable rubber plugs. The pipe was filled with water and the pressure increased one pound at a time until thirty-two pounds had been reached when a pipe near the bottom just above the Y connection cracked as shown on the photograph. The total pressure on the bottom joints was approximately 40 psi. Examination of the crack indicated that the pipe was underburned. The results of the test proved conclusively that the joints and the stopper in the Y will stand several times the ordinary working pressure that they might be put under by a hydro-static test and that therefore the hydro-static test is a fair test and is an indication of the tightness of the joints as well as to the character of the pipe. In fact, it appears to us that at high internal pressure, the weakest link in the work can be the pipe itself. Some of the pipe we are getting today is not so good. In some cases it does not meet the standard specifications, particularly in scoring of the bell and spigot. The dimensions of the bell do not seem to meet the



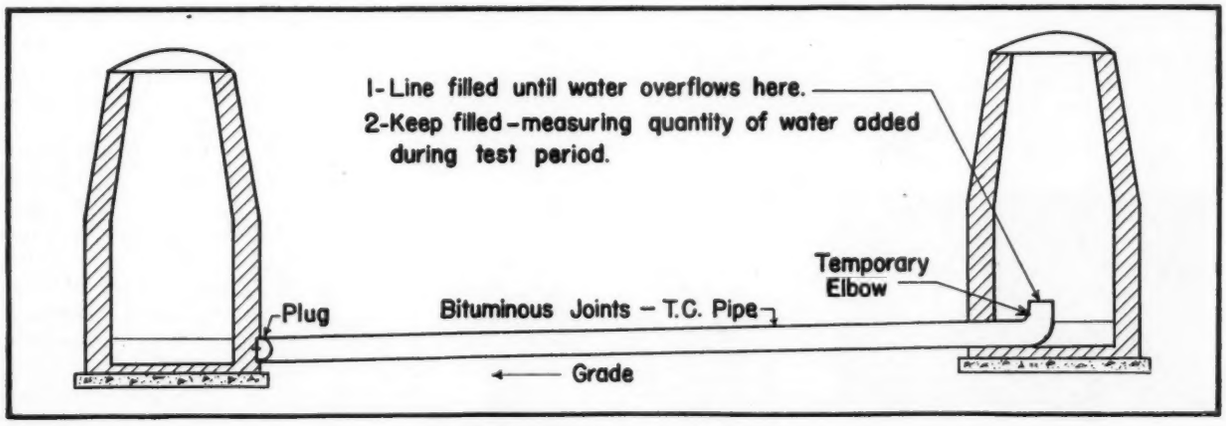
Left, the test line; right, the cracked section of pipe.

specifications and the general character of the pipe seems inferior. The Clay Pipe Association, I know, is doing everything they can to correct this situation. For all practical purposes, even under high pressure hydro-static test, such pipe stands up satisfactorily.

Specifications for Hydro-Static Test

It might be of interest to note here the specifications used for our standard test: "Before any section of the sewer line has been backfilled more than six inches above the top of the pipes the lower end of the section shall be plugged with a suitable plug manufactured for that purpose and satisfactory to the Engineer. The section shall then be filled with water and the leakage measured by the Engineer. In making the test all equipment and water shall be furnished by the contractor and the cost thereof included in the price bid per lineal foot of sewer. In order to pass the above test, the leakage shall not exceed three gallons per twenty-four hours per lineal foot of pipe joints with all joints under a water pressure of not less than one-tenth pound." The same allowable leakage is permitted out of the pipe as called for under infiltration into the pipe. In my opinion, the three gallons is too liberal, and I have recommended it be reduced to two. Three gallons for an 8-inch pipe amounts to over 10,000 gallons per mile. Some excellent results have been secured by the hydro-static test and in other cases some very poor results, as the test shows up poor workmanship. For instance, in one case the stoppers were placed in

(Continued on page 62)


1-Line filled until water overflows here.
2-Keep filled-measuring quantity of water added during test period.
Temporary Elbow
Plug
Bituminous Joints – T.C. Pipe
Grade

Method of making hydro-static test.

Standards and

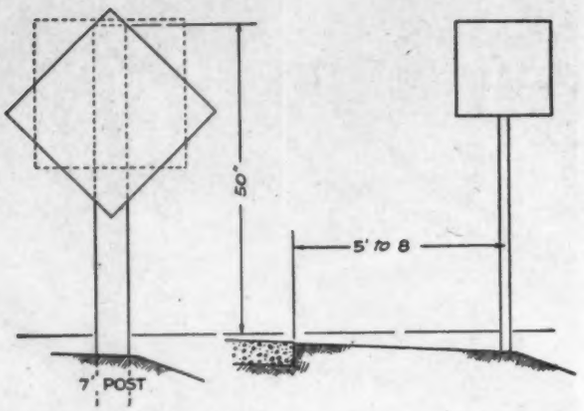


Fig. 1. Sign setting recommended by Kansas.

THE proper design, placement, erection and maintenance of highway signs, whether to direct or to control traffic, is important. Since there is a good deal of interstate traffic, a degree of uniformity is essential, especially in regard to those signs which relate to safety. This article will discuss the practices of several states in reference to position, placement and use of various signs and warning devices.

Position and Proximity of Signs

Fig. 1 shows the method of setting signs recommended by Kansas. Signs are usually set, in that state, at the point of the shoulder, except on extremely wide shoulders; in any case the sign is required to be not less than 5 ft. nor more than 8 ft. from the edge of the pavement or surface. Nebraska places the sign 2 ft. outside the break of the shoulder. Illinois practice is the same as Kansas. California puts the sign 8 to 10 ft. from the edge of the surfacing. Fig. 1 also shows the setting of wood posts, which should be 28 to 30 inches into the ground. Illinois requires a minimum of 2 ft. between the bottom of the sign and the ground line; Nebraska requires 18 inches, and California 3 ft.

Signs should, of course, be placed on the right side of the road and at right angles to it (this does not apply to reflecting signs). They should not be placed behind obstructions, in sags or dips, or on the inside of curves. Two signs should not be placed closer together than 100 ft., if possible. Reflecting signs should be placed so as to face slightly away from the road, as shown in Fig. 2. The desirable amount of deflection varies somewhat with local conditions, but may be about 10 degrees or one-tenth of the width of the sign. Fig. 2 shows how properly and improperly placed reflecting signs look to the motorist. Both Figs. 1 and 2 are from the Kansas State Highway Commission Manual.

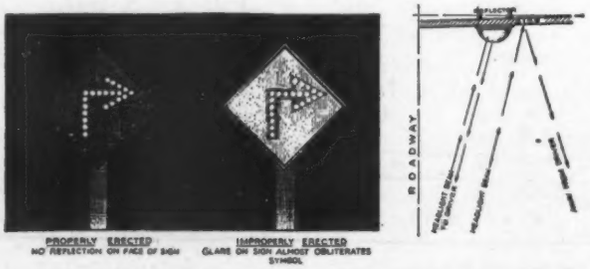


Fig. 2. How to set reflecting signs.

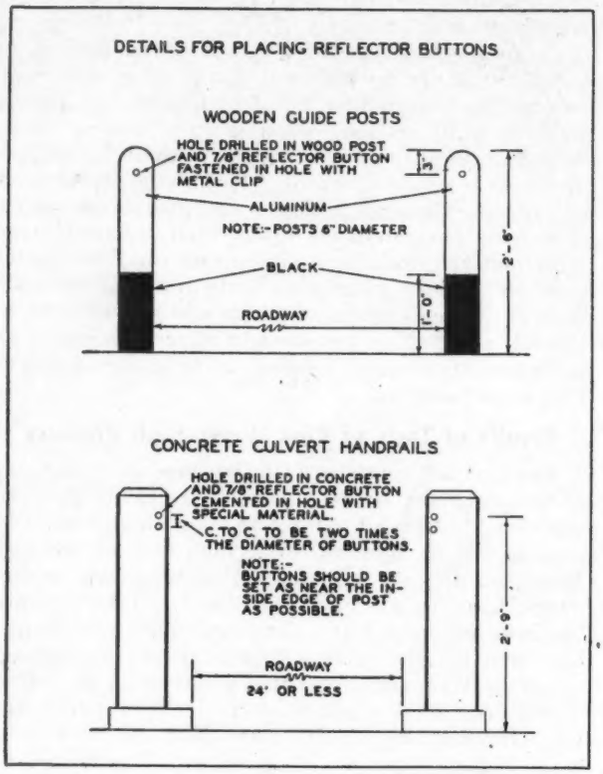

DETAILS FOR PLACING REFLECTOR BUTTONS
WOODEN GUIDE POSTS
HOLE DRILLED IN WOOD POST AND 7/8" REFLECTOR BUTTON FASTENED IN HOLE WITH METAL CLIP
3"
ALUMINUM
NOTE:- POSTS 6" DIAMETER
BLACK
ROADWAY
1'-0"
2'-6"
CONCRETE CULVERT HANDRAILS
HOLE DRILLED IN CONCRETE AND 7/8" REFLECTOR BUTTON CEMENTED IN HOLE WITH SPECIAL MATERIAL.
C. TO C. TO BE TWO TIMES THE DIAMETER OF BUTTONS.
NOTE:- BUTTONS SHOULD BE SET AS NEAR THE INSIDE EDGE OF POST AS POSSIBLE.
ROADWAY
24' OR LESS
2'-9"

Fig. 3. How to place reflector buttons.

The Kansas State Highway Commission says guide or culvert posts should be placed (a) on the outside shoulder of all curves having a radius of less than 1000 ft.; (b) on both sides of the roadway at the end of culvert headwalls; (c) along both sides of a roadway built on a high fill; (d) on the approaches to narrow bridges; and (e) at any other places requiring guideposts for traffic protection. Fig. 3 shows details of placing reflector buttons on wooden guide posts and culvert end posts, according to Kansas standards.

On curves of 500-ft. radius or less, posts are 40 ft. apart; on curves of longer radius, spacing is 50 ft.; on straight stretches guideposts should be spaced 100 ft. apart. Guideposts erected at culvert headwalls should be placed one foot from the end of the headwall, on the approach side only. Wood posts should have a minimum diameter of 6 ins. and a minimum length of 6 ft. with the top 2.5 ft. above the shoulder line. As shown in Fig. 3, the bottom 12-inch strip is painted black; the top 18-inch section is painted with two coats of aluminum paint. Concrete end posts should be painted white with black stripes. Templet details for painting are shown in Fig. 4.

Where extremely hazardous conditions exist, and reflector buttons are used, crystal white elements are used on the right side of and opposing traffic, and

Good Practices for Highway Signs

(Summary of state practices regarding position, placement and use of various signs and warning devices.)

amber or yellow elements are set on the left side of and opposing traffic.

Protecting Maintenance and Repair Workers

Fig. 5, from the Nebraska Manual, shows the sign arrangement to be used at each location where surface maintenance is in progress, even though two or three such set-ups may be needed per mile if several gangs are working. Additional signs, and in some cases flagmen, will be necessary at places where vision is obstructed due to curvature or profile of the road. MEN WORKING signs are to be used only during the period when men are actually at work on the repair. In the daytime, when men are not working and the repair section is not open to use, it is barricaded and marked with red flags. Also, the ONE-WAY TRAFFIC, SLOW and ROAD REPAIR AHEAD signs are left in place. At night, torches are placed in front of each barricade and sign. The ONE-WAY TRAFFIC sign is used only when a portion of the roadway must be closed. Illinois also displays red flags on the ROAD REPAIRS AHEAD sign, but leaves to the judgment of the men in charge whether to put flags on barricade horses. Generally flags are displayed on the first barricade of a series. Fig 6, from the Illinois Manual, shows a standard barricade horse and the proper location of a MEN WORKING sign.

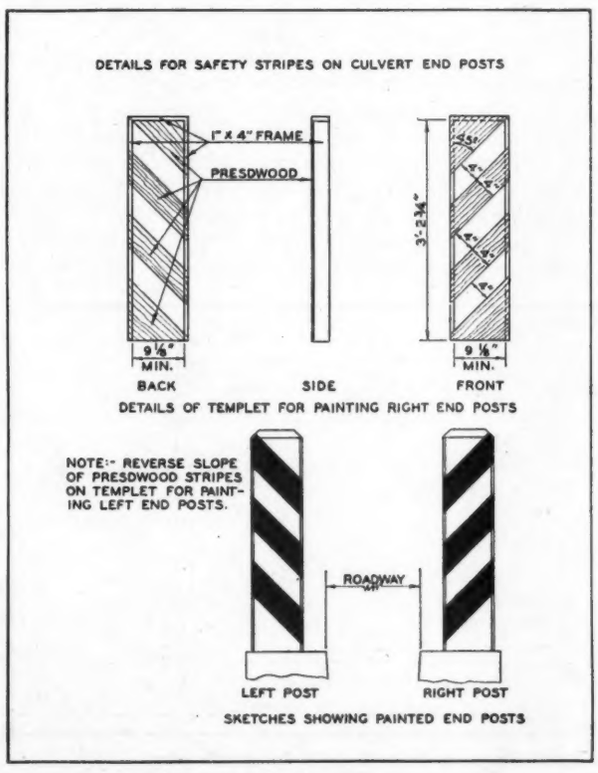


Fig. 4. Safety striping for culvert end posts.

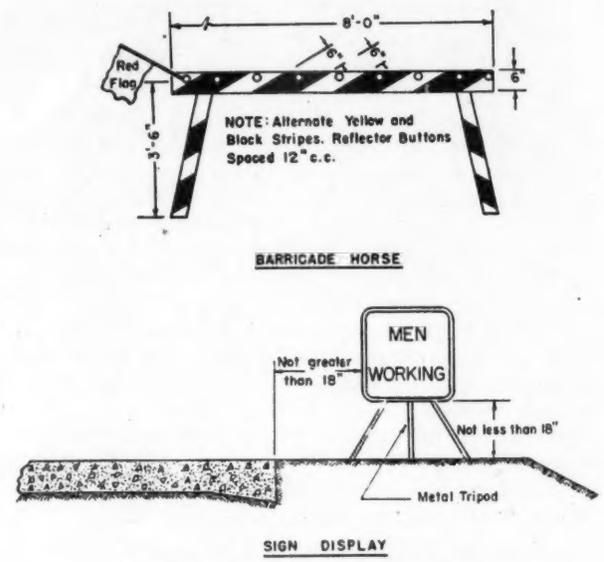


Fig. 6. Barricade horse and sign display.

Further in regard to this subject, the Illinois Manual states, essentially: The protection of working crews on highways where traffic is maintained during repair operations is of vital importance. Of no less importance is the need for adequately warning motorists of the hazards to themselves caused by repairs in the roadway. A series of signs and the standard methods for their use have been developed. Road repair operations normally can be divided into two classifications—"Moving" and "Temporary". The former type is one in which maintenance equipment is moved very slowly along the roadway, thus creating a temporary blockade of a traffic lane. In this type of work, the workmen are exposed to traffic hazards to a greater degree than on jobs where a series of warning signs can be placed along each approach to the location. Consequently, a special plan of protection must be employed.

Where repairs of the moving type are under way, the limits of the zone should be determined by estimating the progress of the work for a one-half day period. A ROAD REPAIRS AHEAD sign should be placed a short distance to the rear of the working

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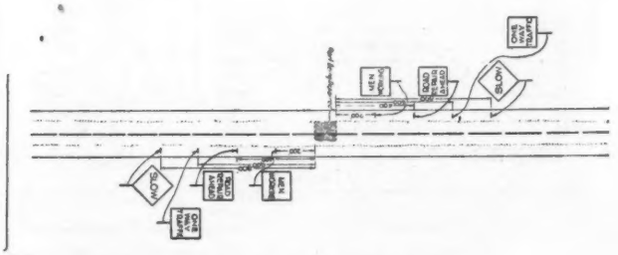


Fig. 5. Sign arrangement to protect maintenance workers.

Cross-Connection and Plumbing Hazard Elimination in Ann Arbor

A project to eliminate existing hazards to the water system and to develop a program to prevent dangerous connections from being made and unsafe fixtures installed.

By H. H. CASWELL
Manager, Water Department

THIS report describes the City of Ann Arbor cross-connection and plumbing hazard survey, and its initiation of a long-range program to safeguard the public water supply from contamination due to these causes. On January 3, 1944, the Common Council authorized the Board of Water Commissioners to engage an experienced sanitary engineer to be placed in charge of the survey and to develop a complete program. This work was to be done under the direction of the Water Department with the expense to be divided one-third each between the Water Department, the Board of Health and the Board of Public Works. The estimated cost for the first year was $3500. Work was begun on the project on February 1, 1944, and has continued to the present, except for about seven months while the engineer was on leave of absence.

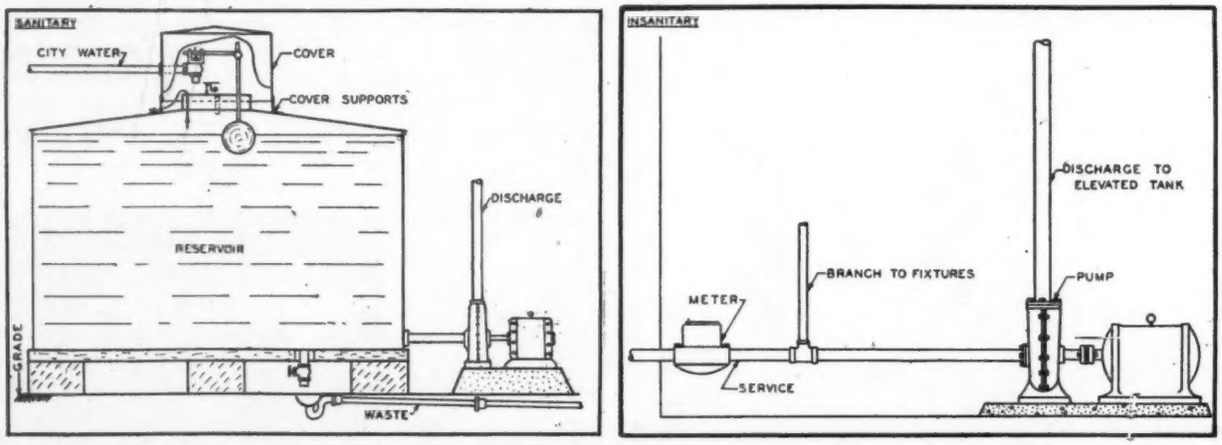
In launching this project, Ann Arbor took a definite and progressive step in protecting the safety of the public water supply. The city has one of the finest water purification and softening plants in the country and provides its residents with a safe and palatable water. Every reasonable precaution is taken to insure that the water is free from disease-producing bacteria when it leaves the treatment plant. It is the aim of this project to insure that the water reaches the consumers in the same safe condition.

A weak link in the protection of the quality of public water supplies is the presence in many cities of cross-connections with secondary supplies of questionable purity; inter-connections with waste systems and sewers through many types of fixtures and water-using equipment; and sanitary defects in fixtures to which city water is supplied. When these conditions exist it is possible under certain hydraulic conditions for flows to be reversed so that instead of water flowing out of the city water piping system, sewage, waste or contaminated matter can enter the pipes intended to contain only potable water. The solution to this problem lies in the elimination of all possible channels between the potable water and any source of contamination.

Method of Making the Survey

In making the survey, it was necessary to inspect the existing plumbing and connections to the city water system in a large number of buildings. Special attention was given to commercial, industrial and public buildings as most of the hazards exist in such buildings. Since there are over 8000 water service connections throughout the city, it was not possible for the engineer in charge of the survey to inspect every building having city water. Assistance was given by employees in the Water Department, such as meter readers and service men. After being taught to recognize cross-connections and other hazards in this category, these men were instructed to report any of these conditions found in the course of their regular work. A large number of cross-connections with cistern water systems, as well as other defects, were discovered by these employees.

The plumbing systems in all larger and more important buildings were inspected by the engineer. A complete record was kept of all inspections, and whenever a condition requiring correction was found, the owner or the person responsible for the maintenance of the plumbing system in the building was notified by letter, recommending the proper correction. In every case where a written notice was sent a revisit was made by the engineer. The purpose of the revisit was to determine if compliance was made and if any assistance or advice was needed to make the proper correction. A



The proper way at the left and the unsafe way at the right to connect water lines. In the unsafe way, a partial vacuum may be created.

revisit also served the purpose of emphasizing that the Water Department expected the elimination of conditions constituting a potential hazard to the public water supply system. In many instances several revisits were required before any action was taken.

One of the biggest obstacles in preventing a more prompt compliance with the Water Department's request was the acute shortage of plumbing fittings and other materials due to the war. Another hindrance was the difficulty in obtaining the services of plumbers to make the change.

The willingness of the majority of the people to cooperate in this program was very gratifying. Most persons did not previously realize that defective plumbing and improper connections to the city water system constituted a menace to public health. One of the most valuable accomplishments of this program was the consciousness of this public health problem aroused among the persons who are concerned with the maintenance and installation of plumbing systems. Even plumbers who had previous knowledge of the existence of this potential hazard were made more conscious of this problem and expressed willingness for active participation in the program.

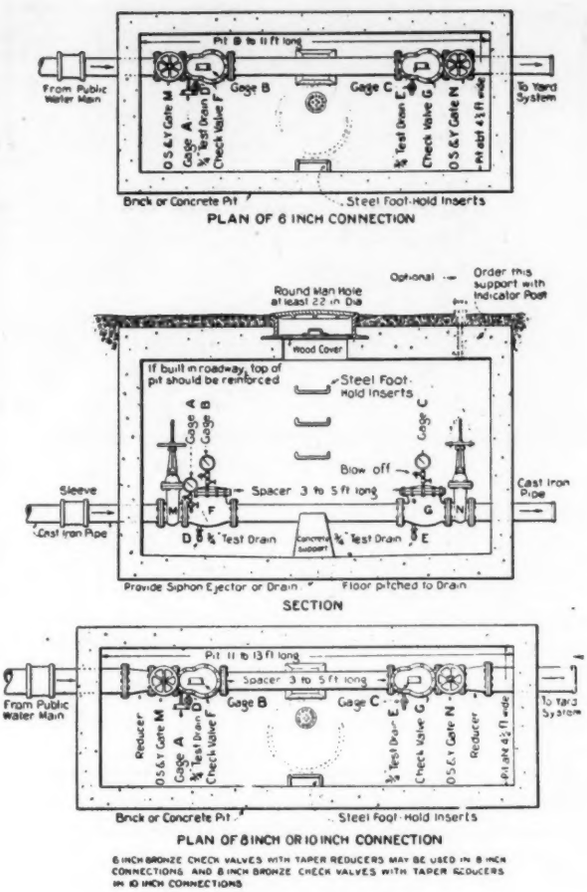
Unsafe Conditions Discovered

The cross-connections and inter-connections discovered during the course of the survey may be classified into three general categories: (1) Direct physical connections to secondary or private water supply systems; (2) Direct connections between the city water supply system and sewer or waste systems; (3) Submerged and below-rim city water inlets to fixtures.

Direct Physical Connections to Secondary or Private Water Supply Systems—This type of a hazard may exist where a secondary water supply system is maintained in addition to city water. For convenience, direct physical connections are frequently made with the city water system without realizing that a potential hazard has been created by such an arrangement. A gate valve or one or more check valves usually separate the systems. If any of these valves leak or are left open at a time that the pressure on the secondary supply side is higher than city pressure, secondary water can enter the city water system. Some of the most serious water-borne epidemics on record were caused in this way.

The safest policy, therefore, is to eliminate existing cross-connections with the city water system and to prohibit new ones from being made in the future. This policy was adopted here under the assumption that the safety of the public water supply is of primary importance and should not be endangered by individuals for reason of convenience. This requirement should be applied to any secondary system regardless of its source of water. Any water other than unaltered city water or city water which has not in any way been subjected or exposed to contamination is defined as being a secondary supply, including deep and shallow wells, surface water from rivers, lakes, ponds and reservoirs and recirculated or reused city water.

At the beginning of the survey, a majority of the secondary supplies in use were cross-connected with the city water system. Of 28 secondary supply systems in industrial and commercial buildings only 8 were not cross-connected with the city water system. Nearly all cistern water pressure pump systems in residences were found to have a direct connection to city water piping. This was also true of private well water systems found in residences. Typical examples of secondary supply systems discovered in the city include a


From Public Water Main
Gage B
Gage C
To Yard System
Brick or Concrete Pit
Steel Foot-Hold Inserts
PLAN OF 6 INCH CONNECTION
Optional
Order this support with Indicator Post
Round Man Hole at least 22 in Dia
Wood Cover
If built in roadway, top of pit should be reinforced
Steel Foot-Hold Inserts
Gage A
Gage B
Gage C
Blow off
Spacer 3 to 5 ft long
Sleeve
Cast Iron Pipe
Test Drain
Concrete Support
Provide Siphon Ejector or Drain
Floor pitched to Drain
SECTION
Pit 11 to 13 ft long
Spacer 3 to 5 ft long
From Public Water Main
Gage B
Gage C
To Yard System
Reducer
Check Valve
Brick or Concrete Pit
Steel Foot-Hold Inserts
PLAN OF 8 INCH OR 10 INCH CONNECTION
6 INCH BRONZE CHECK VALVES WITH TAPER REDUCERS MAY BE USED IN 8 INCH CONNECTIONS AND 8 INCH BRONZE CHECK VALVES WITH TAPER REDUCERS IN 10 INCH CONNECTIONS

Double check valve installation.

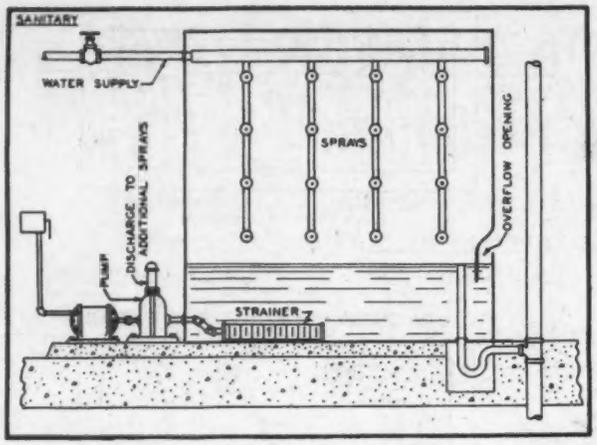
greenhouse drawing water from a manure soakage pit; two factories and two theaters using deep well water for air conditioning; 163 cisterns; 12 other wells; 3 river supplies; and 3 swimming pools.

At the present time 9 out of the 20 cross-connections with secondary systems in industrial and commercial buildings have been completely eliminated. Partial corrections have been made on some of the remaining cross-connections and it will be a matter of a short time before the remaining ones are eliminated. Very little has been done with the elimination of cross-connections in residences but a campaign is now being started.

Direct Sewer Connections — Water-using fixtures and equipment having a direct city water connection and a direct waste connection are listed in the following table which shows the fixtures and the number of each type found:

Type of Fixture Forming the Inter-Connection	*Number*
Air compressors	1
Refrigerator compressors and condensers	16
Hydraulic elevators	3
Ejector sump pumps	8
Priming connection to sump pump	1
Automatic fire sprinkler systems	11
Cooling water jacket on heat treat tanks	2
Blow-off on hot water tanks	2
Cooling coil on x-ray tubes	2
Hospital water sterilizers	9
Cooling jacket on flowmeter test device	1
City water connection to soil pipe for flushing clogged sewer	1

These connections are dangerous due to the fact that it is possible for sewage or waste matter to be drawn into city water piping through an open or leaky



Safe air conditioner connection.

valve if a vacuum should occur in the city water system. The proper correction is to separate completely the city water system from any sewer or waste system. This can be accomplished by providing an air gap either at the point the city water enters the fixture or at the point of discharge to waste, depending on the type of fixture.

In every case where such a direct sewer connection with the waste system was found, a written notice was sent recommending the proper correction. About 25 per cent of these connections have so far been eliminated. This low proportion of compliances is partly due to the presence of a substantial number of these inter-connections in hospitals and university buildings where the cross-connection elimination program has not yet been fully initiated. However, the majority of the remaining inter-connections are expected to be eliminated within a few months. Also, there is not much likelihood that new connections of this kind will be made since the plumbing inspector is now enforcing the recently adopted Ordinance No. 102 which prohibits such connections.

Fixtures with Submerged and Below-Rim Supply Inlets: A hazard is present whenever city water is supplied to a fixture through a city water inlet submerged in the contents of the fixture or when the inlet discharges below the rim of the fixture so that the inlet is submerged when the contents of the fixture rises above its normal overflow level due to clogging of the waste pipe. Contamination of the city water system will take place if a vacuum occurs in the city water system. It is not only possible to contaminate the water supply within a building in this manner but also contaminated matter can be carried by back-flow into the city water main in the street, as has actually happened in other cities.

Fixtures with submerged and below-rim inlets were found in practically every type of a building. These include factories, hospitals, university buildings, apartment houses, doctors and dentists' offices, restaurants, homes and other buildings. The following table gives a partial list of such fixtures found:

(a) Heat treatment, caustic, electro-plating rinse and solution tanks; parts and ball bearing washers and other processing tanks in industrial establishments.

(b) Stomach and gut washing machines, scalding tanks and other processing tanks in a slaughterhouse.

(c) Sludge and chemical mixing tanks in an ice plant.

(d) Washing machines and soap solution tanks in laundries.

(e) Dish washers and other equipment in food establishments.

(f) Special hospital fixtures such as hoppers, bed pan washers, therapeutic tanks and continuous flow tubs.

(g) Common plumbing fixtures such as kitchen sinks, lavatories, bath tubs, laundry tubs and closets in homes and other buildings.

(h) Submerged and below-rim hoses and water-operated aspirators in sinks in various laboratories.

(i) Water-operated aspirators used in funeral homes for the purpose of aspirating fluids from bodies during embalming.

(j) Cuspidors in dentists' offices.

There are two ways of protecting the water system against back-siphonage from fixtures with submerged or below-rim inlets. The safest method is to raise the city water inlet a specified minimum height above the rim level of the fixture thereby making it impossible for contamination to be drawn into the city water pipes under any degree of vacuum.

If a submerged or below-rim inlet is necessary for the proper operation of a fixture, an alternate method of protection can be used. This consists of installing a "vacuum breaker," of which there are several suitable types available. This breaker must be installed in the supply line on the discharge side of the control valve and a certain minimum height above the rim of the fixture.

Although, the principles of back-siphonage prevention are simple, their application is not simple in every case. Some fixtures, whose fault lies in the design, are extremely difficult to correct. Common plumbing fixtures found in homes and other buildings are among those that present this problem, and in many cases no practical means of removing the defect is known except by replacement. Since the hazard caused by a below-rim faucet on a lavatory, a tub or other similar fixture is slight and the correction would require the scrapping of existing fixtures, no correction has been required in such cases. The most good can be done by requiring the installation of only the type of fixtures which are of approved sanitary design. At the present time a majority of the fixtures manufactured by reputable concerns are of approved design as far as this problem is concerned.

On the other hand, numerous fixtures were found which presented a much greater hazard. Here it was felt that a corrective measure was justified and, consequently, corrections were recommended. Many such fixtures were located in industrial and certain commercial buildings. Both hospitals in the city were found to contain a large number of various fixtures with submerged and below-rim inlets. However, it will be a matter of some time before the required fittings and materials can be obtained to eliminate entirely these conditions. The new additions to both hospitals are equipped with fixtures of approved design, indicating that hospital fixtures manufactured at the present time have had these defects largely eliminated.

Much more could have been accomplished if vacuum breakers and other fittings were readily available. In most instances where corrections were recommended, delay of several weeks or months, due to this reason, was not uncommon.

Conclusion

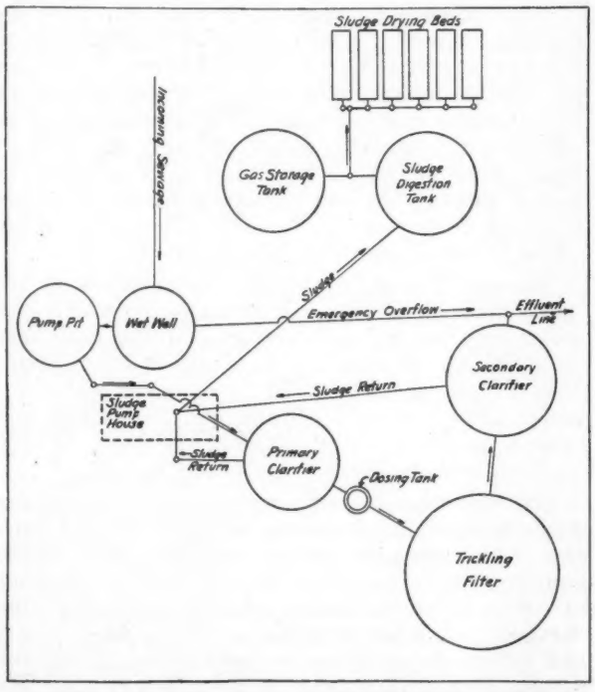
The determination of the extent of the hazard and the procedures taken to eliminate cross-connections and interconnections represent two of the principal phases of the work. The third step dealing with the establishment of a long-range program for the control of these hazards was the preparation and passage of a suitable ordinance. This ordinance, No. 102, adopted Dec. 17, 1945, provides for the control of connections to the city water supply and the regulation of fixtures and installations on all new and replacement plumbing work.

Left, primary clarifier, digester and gas holder; right, pumping station and sludge pump house.

Sewage Treatment History and Difficulties At Carlsbad

By E. A. ROBERTS
City Clerk

CARLSBAD, NEW MEXICO, was originally served by drains about a third of a mile long, emptying into the Pecos River. These drains or sewers were extended from time to time and, in 1908, a rather elaborate sewer system was installed, covering the main business district and the older residential section but still emptying raw sewage into the river. From time to time this system was extended but no provision made for a treatment plant. During PWA days, in 1938-39 bonds were voted and work started on a comprehensive sewer system and treatment plant. The contractor ran into many difficulties with rock and surface water but finally completed the job. This treatment plant included a primary clarifier, a trickling filter with secondary settling tank, and a digester and gas holder. Sewage gas from the digester was used to operate two 45-hp. four-cylinder Climax gas engines direct connected through Johnson gear heads to two 8" Fairbanks, Morse & Co. sewage pumps in a wet well compartment. The sludge pump, clarifier rakes, and the other auxiliary equipment were electrically driven with purchased power.



Layout and flow diagram of the Carlsbad treatment plant.

Four operators were employed at the plant and operation continued until September, 1941, when a terrific flood from a normally dry arroya overwhelmed it. The tanks and filter were filled with sand, pipes were broken and the plant was completely wrecked. Raw sewage was again turned into the river and after installing a watchman and taking the rock out of the trickling filter with a drag line, the plant was virtually abandoned.

In the spring of 1945, the Council ordered the plant rehabilitated and put in operation. Conditions as regards labor and material could hardly have been worse but the job was started. First the broken drains in the bottom of the filter bed were replaced, the drag line having broken most of them when the rock was removed. Filter rock was then replaced with a tractor and carry-all. To remove the dirt, a fire hose was played on the rock as it was dumped and between trips of the carry-all and the sand and dirt flushed off to the river. After approximately 4500 cubic yards of rock had been replaced in the tank which is 150 feet in diameter and 7 feet deep, the tank was filled with water several times and drained. This carried out the dirt and sand in the bottom and in the drains very satisfactorily.

It was certain that four operators could not be obtained and also that if they could be found, the city could not afford to pay four men. It was therefore decided to install electric power and make the plant as nearly automatic as possible. One engine was uncoupled from its gear head and a 40 HP 220 volt 1740

rpm motor V-belted to the head. A B/W floatless float control was installed to stop and start the motor, stopping it when the wet well was pumped down and starting when the sewage level reached the overflow point. Pulley ratios were figured to give a pump speed that would handle a little more flow than the maximum so that the motor would always dewater the wet well given time. It was first thought that a variable speed motor should be used but this got into so much complication that the start-stop plan was adopted. The normal flow is 1900 gpm with small daily and seasonal variations but the motor and pump as operating have handled the sewage perfectly. If the flow falls below normal the wet well is dewatered in less time and it is longer before the motor starts again and if the flow increases the motor will stay on until the well is pumped down. The load is about 25 HP and the power bill runs around $120.00 per month. The saving in labor by having one operator instead of four is between $500 and $600 per month so the gain is appreciable. Waste gas is burned.

Digested sludge is drawn off and dried in beds. A market is assured for the dried sludge for fertilizer but none has been sold yet.

An estimated population of 15,000 is being served which would usually give a sewage flow of 1,500,000 gpd. The plant actually handles 2,700,000 gallons of raw sewage per 24 hours. This is caused by infiltration of ground water and is not altogether a disadvantage as it gives a diluted effluent. However, the infiltration is fixed and will result in overloading the lines and the plant before the designed capacity of the plant is reached. Water consumption in Carlsbad varies between 1,750,000 gallons per day in the winter to a maximum of 5,300,000 gallons per day in the summer. On account of the large percent of infiltration the sewage flow does not follow this variation.

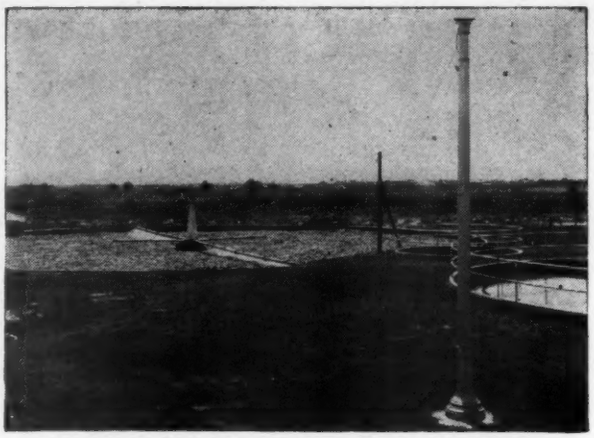
The flow diagram illustrates the operation of the plant. There is one lift station which was described in the November, 1944, issue of PUBLIC WORKS and the water system of Carlsbad was written up and illustrated in the March, 1945, issue of this magazine.

The one operator lives in a city owned dwelling on the grounds and has no difficulty in taking care of the plant. He is given additional help when conditions, such as repairs or cleaning tanks, make it necessary. There is a pilot light in his house that burns when the main pump is running. In case of trouble of any kind, there is an overflow line to the river that operates when the water level in the wet well goes one foot above the motor cut-in point. This has operated only once, when there was a power failure. On resumption of voltage the plant starts up automatically and it is not necessary for the operator to make any changes. He may not even know of the failure although he is supposed to keep a record.

Coils using soft, waste-gas heated water can be used to raise the temperature of the sludge in the digester when necessary. The second gas engine is kept as a stand-by. In the meantime operation is proceeding very satisfactorily with the one motor and pump and conditions in the river below the plant are much improved.

Inspecting Interceptor Connections

The purpose of interceptors is to prevent the discharge of polluting matters into streams, except when such matters are greatly diluted in the sewers and the stream flow is greater than usual. If the interceptor connections become clogged, however, they fail to protect the streams. We wonder how many cities inspect their interceptor connections regularly.



Primary clarifier (right); dosing tank, and trickling filter.

Indianapolis has 120 such connections, and in 1945 found 195 stoppages in them, about half of them in 10 connections. Five of the connections were clogged a part or all of every day. The city is planning to change the connections to a type that will not clog readily.

Designing Water Works and Sewerage in Central America

By JOHN K. CHATTEY

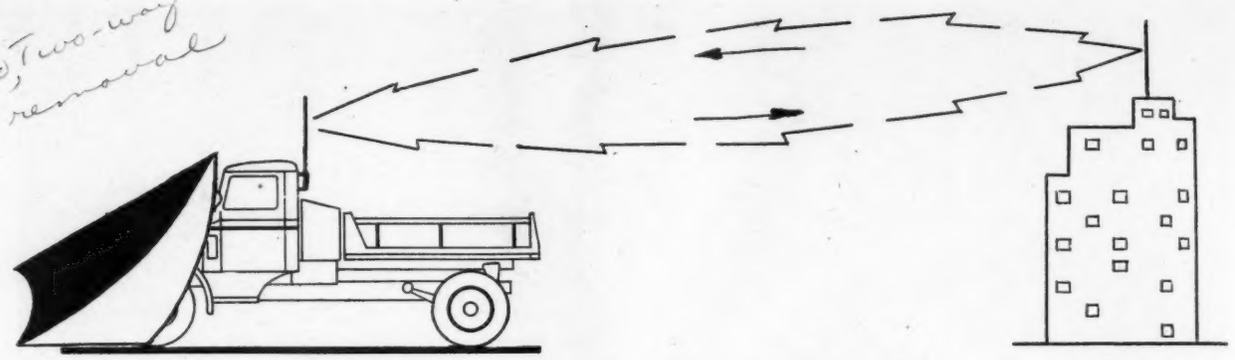
(From a personal letter to the editor)

DOWN here where my work is that of a consulting sanitary engineer, I find some variations from standard procedures used in the U.S.A. We have completed plans and recommendations for a water supply and sewerage system for the town of Coban, about 125 miles northeast of Guatemala City. It is a town of about 5,000 people, situated in the highlands and surrounded by coffee plantations. The source of water is a mountain stream about two miles from the town. Sewage disposal is by dumping it untreated in another stream below the town, for which there were economic reasons.

When it came to establishing water rates for the domestic consumers, we set a price of $1.50 for 60,000 liters per month and above that a flat rate of 10 cents for each additional 1,000 liters. This procedure is not in conformity with good practice back home, where we are interested in having people use large quantities of water. Here, not only does a plant need municipal or federal support, but also special considerations should be given to the very poor families. There are many whose income is less than $50 per month.

The standard of living of such families is so low that a water supply must be considered as a unit in a health program, just as is the hospital. For these very poor families we have set up a rate of 75 cents for 30,000 liters per month, and 10 cents for each additional 1,000 liters. In addition, we recommend that there be provided several public places where the very poor can come and draw water from a tap.

This may all seem confusing yet it is a forward step from the average town water supply which is invariably highly polluted, scarce and often interrupted. Outside of Guatemala City there is little or no means of collecting and disposing of sewage. Through the Servicio, we did put in partial systems in both Ayutla and Jutiapa. In every case, we try to avoid complicated systems with moving parts, or ones which require very much maintenance.



With two-way radio, the plows are always in contact with headquarters.

Removing More Snow With Fewer Plows

How progressive counties are saving time, money, labor, and—possibly—lives by using 2-way radio.

"We have used two-way radio for our snow plows for about eight years with outstanding results. If the facts could be verified, our radio equipment has undoubtedly saved lives and many people from exposure to the cold. Besides these, two-way radio makes it possible to keep shifting your equipment to the points where it is needed most during storms. Much time is also saved by disabled equipment operators being able to report their locations and needs. We can honestly say that two-way radio is one of the best investments that a county can make."—E. Francis Brunette, County Highway Commissioner, Brown County, Wis.

"In 1941, we had 36 units for snow removal on our 700-mile highway system. The great demand for construction equipment left us with 12 less snow removal units at the beginning of the 1942-43 winter season. This sounds like a catastrophe, and I was worried. With one-third less equipment, how were we to keep the highways safe? But we did; and the winters were just as bad. The answer was that we had two-way radio. We were able, through the medium of this radio to dispatch equipment as it was needed, instantly from one point to another. There was no lost motion. Each and every man was performing *useful* work. Aside from spectacular life-saving, which has occurred in my county, there is the day in and day out increase in efficiency, maybe not so dramatic as the rescue angle, but certainly very interesting to those who pay the bills. There is also the increase in safety to personnel. Radio has a powerful effect on the worker's morale; he will not hesitate to go out in the worst weather when he knows that help is no further away than the microphone on his dashboard."—W. Bruce Chilson, Superintendent of Highways, Chautauqua County, N. Y.

Brown County, Wis., was the pioneer in the entire nation in the use of radio on snow plows, according to Mr. Brunette, for the Federal Communications Commission had to alter its rule to allow that county to use radio. Back in 1935, the people of Brown County contributed enough money to a Citizens' Committee to build transmitter KNHB. Radio receivers only were used at first, with fair results but there was no certainty that the drivers had received the call unless they acknowledged it by telephone. This was not the best, but it was better than relying on personal contact with the plows. Costs were reduced and service to the public improved. The next step in Brown County was two-way radio, which has now been used about eight years. At present, the county is installing a new FM system to make service even better.

Radio is also used by Brown County for maintenance and other highway work all the year around, and it has been found to have many advantages and economies. Altogether, some 8 counties reported that they were now using two-way radio for snow removal; and altogether about 120 counties reported in a special PUBLIC WORKS Magazine survey that they were interested in two-way radio. Similarly, about 100 municipal water departments reported, in another survey, that they too were interested.

The Federal Communications Commission has set aside a group of frequencies for the use of highway departments, among which are 4 channels in the 30 to 40 megacycle band and six channels in the 42 to 44 megacycle band. Other channels, above and below

(Continued on page 60)

Two-way radio-equipped plow, Brown Co., Wisconsin.

Salt keeps the snow mealy until plowing can be completed.

Cincinnati's Cliff Dwellers Get Stepped-Up Winter Protection

C. E. BROKAW

Superintendent of Public Works, Highway Maintenance Division, Cincinnati, Ohio

THE modern cliff dwellers in Cincinnati come in for a good deal of consideration once the cold season begins here. Though these hillside residents don't scramble up and down ladders to get to and from their homes, they do use steps—there are 25 miles of concrete steps leading from one street level to another throughout the city. We make sure that these are safe and free of slippery snow and ice during the winter months, but that's just part of our snow and ice removal project. In addition, there are 700 miles of hills and streets to keep open, one-quarter of which have grades ranging from 6 to 21.5 per cent.

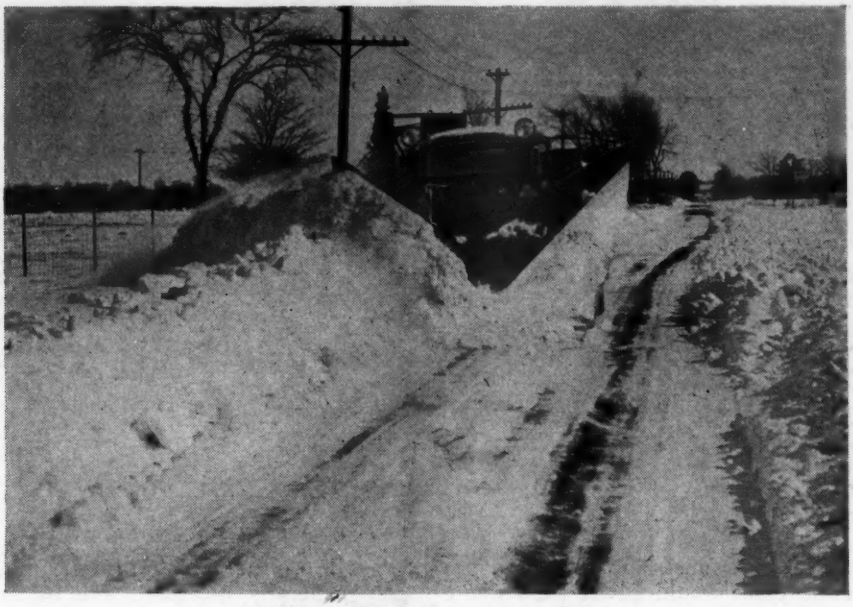
However, by dividing the city into four major zones, each of which is operational headquarters for a completely equipped section, and by timing all department activities to cover hazardous points immediately, we have been able to put the heat on winter weather and keep a jump ahead of even the worst storms. A fifth special section is detailed to clear snow and ice from the miles of steps and walks when bad weather breaks. All section units regardless of the zone in which they work function interchangeably in all slippery street operations.

Check lists of streets and roads with a 6 per cent grade or more are maintained at each zone base. These come under the primary or hazardous street rating—as do all important viaducts, winding roads, bridges, express highways and intersections—and are slated for immediate attention when a storm hits. Once these routes have been treated, the crews move on to other streets in order of their importance to traffic and pedestrian safety.

To keep pace with changes in techniques and trends in winter safety campaigns and to build a more integrated organization, our Highway and Maintenance men are given special training in early fall. These sessions stress the value and advantage of accurate timing in snow-fighting operations. New drivers particularly, devote about ten hours during this season to the study of local traffic conditions and to the types of grades they must first service in the section to which they are assigned. They must also be trained to handle with maximum efficiency the costly and specialized equipment they operate. From an economic standpoint, this type of planning pays off in substantial savings in repair costs and, more important, the machines are available when they are needed.

In the early fall about 20 stock piles of rock salt and abrasives are built up and in late fall we begin in earnest to plan for storms that may occur from November until the end of March. Because we have always been short of labor we have gone almost 100 per cent mechanical in our operations. The department's total equipment consists of 60 dump trucks, 13 centrifugal disc-type rock salt spreaders, 6 mechanical loaders, 4 tractors and a bulldozer. Bad as our blizzards are, we manage to clear all pavements in record time, dumping snow down four main sewer holes. These are equipped with a spray that throws

(Continued on page 58)



A V-Plow widens and clears a roadway.

Good Practices in Snow Removal, Drift Prevention and Ice Control

A summary of policies and procedures in winter engineering as prescribed by leading State Highway Departments, based on Instruction and Maintenance Manuals.

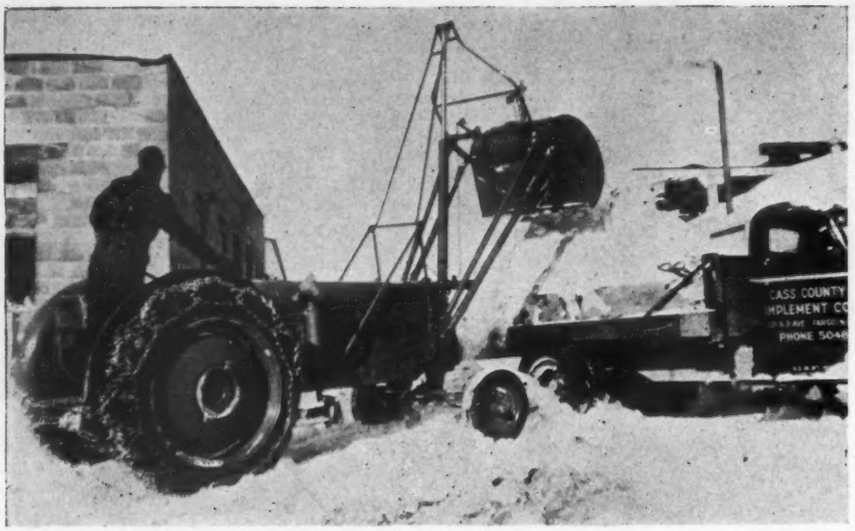
SNOW removal, including ice control, should be provided on all regularly traveled roads and on all city streets. While the general policy should be to give the greatest aid to the greatest number of the traveling public, within the limitations of equipment and personnel, similar service should be extended to all highway users so far as possible. In order to do this, the work must be carefully planned and organized.

Pre-Winter Preparation

Organization.—Each district supervisor in Connecticut is required by the first of November to have his forces organized and a definite plan of action prepared whereby all roads are accounted for, routings for operation are listed, and each man and each piece of equipment has a definite job and a specific territorial assignment. In California, organization and assignment of territory to specific personnel must be completed before the beginning of the winter season. Organization for snow removal must be perfected before the snow season in Pennsylvania, the superintendent and his assistants being responsible that foremen receive and understand instructions. Missouri requires that a snow removal schedule be prepared in the early fall. This schedule lists all snow removal equipment, with number, size, make and type; gives the name and telephone number of each operator and helper; shows day and night crews; gives plow routings and contact points; assigns Highway Department personnel and routes crews from principal offices. A copy of this information is placed in every piece of snow fighting equipment.

Application to Cities.—The principles of pre-winter preparation apply with equal or greater force to cities, where the density of population and the necessity for the continuous flow of traffic combine to make immediate snow removal most important. Plans for snow plowing, snow removal and ice control should be made in the early fall. These plans should provide for the following: (1) A census of equipment available, and timely ordering of equipment needed, to do a good job; (2) repair and maintenance work on existing equipment to assure that it will be in the best of shape for winter use; (3) specific arrangements with other city bureaus and with private agencies for additional trucks and tractors; (4) preparation of a specific plan of action for snow plowing and snow removal, with definite routes or streets assigned to each plow and to all personnel, as indicated in the paragraph above; (5) designation, in order of importance, of streets from which snow is to be *removed,* and arrangements for snow loaders and trucks for the work; (6) selection of specific and convenient areas for dumping snow. This plan should be written out and copies given to all foremen and other key personnel. Ice control, which is discussed more fully in later paragraphs of this article, should also be planned.

Cooperation with Others.—Trucks and equipment of others are often available for snow removal. This equipment may include other bureaus or departments of a city, county or state; bus or street-car companies: and occasionally other agencies. Those in charge of snow removal should make definite arrangements with the heads of other bureaus or departments for the use



In an emergency many kinds of equipment can be used for snow removal. This shows a Huber lift-loader being pressed into service to handle a heavy fall of snow in North Dakota. The truck body is not ideal for hauling snow.

of their equipment and personnel, and, in accordance with the organization plan, should advise them where the equipment is to be used and the men are to report. Definite arrangements should also be made with bus and street car companies for cooperative work. This cooperation should not be restricted to snow removal, but should include reporting of conditions and other pertinent data.

Preparation of Equipment.—Connecticut requires that all equipment to be used on snow and ice work shall have been overhauled and shall be in readiness for immediate use by the first of November; and that underframes and other attachments are on trucks by that date. Since all motive power units are normally used constantly on routine maintenance, close cooperation between the maintenance and equipment departments is necessary to insure that these are checked and reconditioned in time. Missouri shifts trucks to be used by special snow fighting crews to winter headquarters in early November. Missouri further states: "All 1½ and 2-ton trucks should be equipped with one-way plows and larger trucks with V-plows. It is important to select the correct size of plow; a common error is a plow that is too large. During early November, plows should be moved inside buildings where they can be mounted on the trucks in dry, warm, well-lighted surroundings." Other states have different routines regarding size of trucks, and sizes and type of plows.

Missouri provides each unit to be used on snow removal with an extra fan belt, light bulbs, fuses and a roll of tape. In a snow-tight box in the truck bed are scoops, extra motor oil, flashers, Toledo torches, tire chains, a tow chain, snow plow shoes and small tools. A barrel of gasoline is placed in a specially constructed rack. A short hose with attachment is provided for transferring the gasoline to the tank. Motor graders are considered valuable units for snow removal and are equipped the same as trucks, with snow plow identification lights, heater and windshield defroster.

Missouri uses crushed stone or gravel for ballast. This should be stored under cover so it will be convenient for loading and will not be frozen when needed. Such ballast is useful if equipment becomes mired on soft shoulders. Safety lights should be installed and maintained in operating condition at each end of snow plow blades. These should be so designed that the right light can be removed readily when banks must be plowed.

California keeps equipment sheltered, when idle, and in condition for quick starting. Heated quarters are generally provided. The ballast load is usually kept in place and the truck jacked up to relieve the spring load when it is in storage. Snow plows are treated as follows: Rust is removed with wire brushes; the surface is coated with Murphy's sealing primer and allowed to dry thoroughly; and then is covered with a standard paste wax, Johnson's or equal. When rewaxing, all wax is removed with turpentine and the surface reprimed and rewaxed. Plows should be kept waxed, ready for each storm.

Equipment is serviced at the end of each storm and at opportune times during storms.

Location of Equipment.—Pennsylvania keeps most of its equipment at county maintenance buildings, but finds it desirable to store some of it at various locations in each county.

Types of Equipment. — One-way, blade plows, mounted on trucks, which are effective on snow not over 12 ins. deep, ordinarily do the bulk of the snow removal work. Reversible blade plows are used with trucks, motor graders, maintainers, and tractors, principally for clearing streets, piling snow along curbs or in street centers in urban areas, and for clearing parking places. For handling deep snows and drifts, V-plows, mounted on larger trucks are used. Rotary snow plows are efficient and needed for the heaviest drifts and deepest snow; usually they are tractor-mounted. Their efficiency is greatly increased and their field of usefulness markedly augmented by the installation of 2-way radio, as indicated in an article on another page of this issue. For city streets, the power snow loader is essential, as it will pick up packed or frozen snow at rates of as much as 10 cu. yds. per minute and load it into trucks. For a full description of equipment for snow plowing and snow removal, see the *Street and Highway Manual,* which is published by this magazine.

Weather and Other Reporting.—Definite arrangements should be made to receive weather reports promptly, both forecasts and actual conditions in various parts of the areas to be served. Storms may vary greatly in intensity in different sections of even a small county; sometimes of a city.

Of even greater importance is to establish an effective and workable system of contact with the men operating the plows. Limited experience with 2-way radio has demonstrated that it increases the effectiveness of a fleet of equipment by 30% to 50%. Where it is not available, arrangement should be made for

A wheel tractor with a 3-position, one-way plow and snow-dozer working near Batavia, N. Y., last winter after the heavy storm which in nearby Buffalo produced 48 ins. of snow in 51 hours. The best of organization and equipment is required to cope with such storms.

telephone communications. When the plowing routes are laid out, rural houses having telephones should be indicated on the route chart so that operators will know where these are. One state assigns an automobile and driver to each plow during the night "to assist in handling traffic, report to the Division Office, and haul relief operators and parts. This is a great timesaver and gives operators a feeling of safety during blizards."

"Top service to the traveling public . . . can only be accomplished by keeping in touch with the plows through contact points in order to know the actual conditions in the field. This requires someone on duty 24 hours per day during the storm . . . An accurate account of all reports received from plows as to conditions in the field and instructions issued" should be maintained.

Drainage Outlet and Other Markings.—All important drainage outlets that are likely to be hidden by snow or ice are marked with concrete posts in Connecticut. California puts 2″x2″x8′ marker posts, painted orange, on one side of the road at the outer shoulder edge, at whatever intervals are necessary for visibility, as a guide for plow operators.

Snow Removal Operations

General Preparedness.—The Missouri Manual summarizes this subject excellently, as follows: "Be prepared at all times to take care of the worst possible snow or ice condition that may occur. Check your snow-fighting and ice-control equipment frequently, so there will be no delay when the equipment is needed. Snow removal and ice control can be handled only by being ready when snow starts falling or ice forming. Start snow plows as soon as there is enough snow to plow. Organize your labor in such a manner that it will know exactly when and where to report in case of need." . . .

Public Relations.—An important phase of snow-removal work is the collection and dissemination to the public of reliable information regarding travel conditions during storms. This also requires preparation in advance, including making arrangements with radio stations, newspapers, automobile clubs and filling stations for spreading the news. In order to obtain information of a reliable and helpful nature, plow operators and others must be instructed in some detail as to the nature of their observations and reports. The 2-way radio is exceptionally helpful in this phase of the work also.

Classification.—The type of plow most efficient or necessary for snow removal determines the general classification of the work. However, Missouri divides snow removal work into two classes: (1) *Light,* which is snow that can be removed by one-way plows on light trucks and by motor graders. The important phase of this work is to start plows as soon as snow starts falling so that it may be removed before it becomes packed on the pavement. (2). *Heavy* snow requires V-plows or rotary plows, as it is too heavy to be handled by the one-way plows, either because of the depth of the snowfall, or because of drifting.

When to Start Plowing.—As already indicated, Missouri starts equipment as soon as snow begins to fall. Pennsylvania starts the snow plows when snow on level ground has reached a depth of 1 inch. Connecticut starts "as soon as the snowfall is of sufficient depth for equipment to work efficiently." California starts removal "with the storm or as soon as the fall is of sufficient depth for the equipment to work."

Details of Plowing.—General practices in snow-plowing are well established and need not be detailed here, but some of the data in the Missouri Manual are of interest. That Manual says: "Snow should always be plowed away from the direction from which the snow is coming so as to avoid windrowing snow on the storm side of the road which might cause excessive drifting. For the first trip through a drift, the snow plow should be on the shoulder, if possible, on the side from which the storm is coming. This may require plowing against traffic, which creates a hazard and necessitates very careful driving. In winging snow off the pavement, the snow should be spread instead of windrowing it on top of the bank, which would cause a deeper drift if another storm follows. Also, snow should not be piled on the high side of curves, as it may melt and run across the roadway, creating a hazard.

Personnel Handling. — Arrangements should be made to relieve crews so that men work eight hours only, except for short emergency periods, and also to provide one day of rest in seven. The helper who is assigned to each truck should be able to operate it, thus relieving the regular operator from time to time. When mechanics go out on repair work, and especially when they may go from one repair job to another, a helper should accompany each and act as driver or relief driver. Experience has shown that a mechanic can obtain some rest in such cases.

When to Stop Plowing.—Pennsylvania continues plowing until snow stops falling and after that until all routes are cleared. Plowing is then continued until the snow is pushed back at least 3 feet wider than the pavement so there will be room in case of additional snowfall. Missouri does not consider snow removal complete until all Federal and State routes have 2-way traffic and all supplementary routes are open for one-way traffic; and until all snow has been removed from

We asked the snow-removal men and here's how they say

CARL D. WARNER,
Supt. of Sanitation,
Detroit, Mich.

"One of our best time and money savers is . . . rock salt; we've had more than seven years of experience with it, and we rely on it so heavily that during an average winter we spread it on our streets about 35 times. Applied immediately at the beginning of a storm it, plus traffic, does 80 per cent of our snow and ice removal job and gives local motorists dry, snow-and-ice-free streets from curb to curb all winter long."

EDWARD F. MORGAN, Jr.
Superintendent of Streets,
Hudson, Mass.

"Efficient handling of available equipment plus the extensive use of rock salt as a snow and ice remover in place of manpower has enabled us to save money and keep open our many miles of paved and unpaved streets. Rock salt is less expensive to use than sand, fewer men are needed to apply it, and generally, one application is enough. Added to all this, it doesn't have to be dug out of the sewers in the spring."

and "SALTY" says-

"Remove snow and ice! Don't treat it!"

Treacherous ice and packed snow on traffic arteries mean accidents, injuries... death! "Treating" these hazards with abrasives accomplishes only temporary results.

Quick, effective removal of snow and ice with Sterling "Auger-Action" Rock Salt gives a bare, dry pavement . . . the safe driving surface.

But it's of utmost importance that you estimate your requirements now . . . and plan your needed storage . . . to be sure you have *enough* on hand for severe continuing storms. Order your Sterling Rock Salt—*today!*

Get the full facts in our new 1946 bulletin! Fill out and mail the coupon for your free copy. *Now!*

INTERNATIONAL SALT COMPANY, INC.
Dept. PW8, Scranton, Pa.

Gentlemen:
Kindly send me free of charge and at once a copy of "Why, When and How To Apply Sterling 'Auger-Action' Rock Salt."

*Name*_____

*Title*_____

*Street*_____

*City*_____ *State*_____

experts to write this ad...

"PASS the SALT"

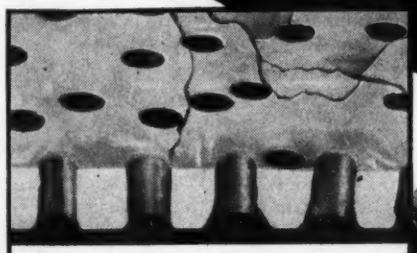
FRED HAMMERLE,
County Engineer,
Butler County, Ohio

"We spread Sterling Rock Salt at the beginning of a storm, especially at the places our men know from experience to be dangerous, because it keeps snow mealy and prevents ice from forming and bonding to the pavement. This makes ice and snow removal easy, and enables us to save money on plowing costs."

ANTHONY MARTINI,
***Superintendent of Public Works,* Passaic, N. J.**

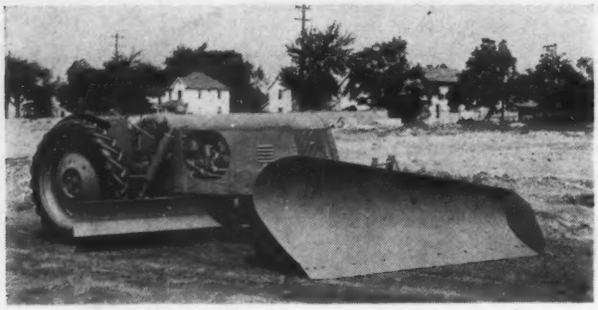
"We now practice snow and ice removal—with rock salt—rather than just treatment. It pays off in better service for our motorists and less work for us—no more laborious hand chopping to get the ice off. And rock salt will keep snow from bonding to the pavement when the next snowfall hits and give some protection to pedestrians and motorists before our equipment goes out."

Sterling
Auger-Action ROCK SALT



★ Assures quick removal
★ Saves labor and equipment
★ Makes driving safe

When you need special information—consult the classified **READER'S SERVICE DEPT.**, *pages 67-69*



A Huber power unit and snow plow.

the road shoulder, spillways opened, and pavement and bridge floors cleaned.

Snow Fence and Drift Prevention

Locations subject to drifting should be studied to determine effective preventive measures, and the causes of drifting should be eliminated where possible. A high gradeline may prevent drifting by allowing the wind to clear the roadway. Proper trimming of roadside trees may mitigate or prevent drifting. However, in most areas artificial snow fence must be relied on for the major job of drift prevention.

Since practically all snow fence is erected on private property, permission must be obtained from the property owner to place the fence on his land. Usually this is easily obtained by explaining to the property owner the value of the snow fence to the public. In following years, permission may depend on cooperation with the property owner, as by erecting fence at a time that will lease inconvenience him, and removing it in the spring at the time he requests. Also, in placing, care should be taken not to damage the land or crops; in pastures, openings may be left between panels for stock to pass through, the distance between openings meeting with the property owner's approval.

When Erected.—The date when snow fence should be erected obviously depends on climatic conditions. In general, it is a good plan to get it up early and take it down late. At any rate, the posts should be set before the ground has been frozen. Connecticut erects snow fences each year prior to frost. Pennsylvania starts work on November 1, and completes erection as promptly as possible. In California, there is such a wide range of climatic conditions, that no specific date can be set. By placing posts before the ground is frozen, the posts freeze firmly in place and will then hold against the most severe winds.

How and Where to Locate.—The exact location of a snow fence can best be determined by a careful study of the topography from year to year, noting previous conditions, surrounding terrain, and natural and artificial snow barriers. After severe storms, results should be checked by a field survey. While experience of previous winters is of much value, rotation of farm crops may require changes in snow fence location from year to year. Fields of corn stalks, weeds and other vegetation will usually prevent drifts, but a fringe of these along the roadside may cause drifting.

The amount of snow fence used on a road should be governed by the importance of the road and the severity of drifting. Consideration should also be given to locations that are at the extreme end of a snow plow route.

Distance from Road.—Pennsylvania, in its Manual, recommends that fence be placed 75 to 150 feet from the road, depending on whether the road is located in cut or on fill, or if the adjoining ground is level with the pavement, but gives no detailed directions for placement. Missouri usually places fence 60 to 100 feet from the road, depending on the natural slope of the ground in the vicinity. California considers the slope which the snow drifts assume. If the slope is 6:1, the fence 5 ft. high and the distance from the center of the roadway to the ditch is 15 ft., the fence is placed $6\times5+15=45$ ft. from the road; and if the snow drifts on a 12:1 slope, the distance from the center of the road to the snow fence location would be 75 ft.

Other Details.—Missouri recommends an angular setting under certain conditions. For instance, on a north and south road, 50-ft. sections of fence set 45° to the road will stop all drifting from storms between northwest and due north and will save some fence. In most areas, some consideration should be given to the direction of the prevailing winter winds; and the possibility of drifting by winds from other directions should be considered also.

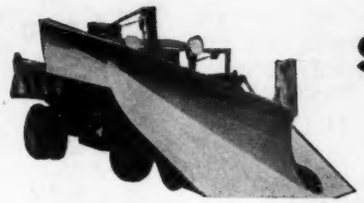
The sections on erecting and handling Snow Fence and on Ice Control will appear in an early issue.

City Practices in Mapping Street Subsurface Structures

A survey of practices by cities in regard to mapping subsurface structures under streets has been made by the Editors of PUBLIC WORKS. The following data summarize the returns from the first 500 replies received in response to a questionnaire.

Alabama—Of 3 cities reporting, only Tuscaloosa had mapped the structures under its streets. None of the cities reporting from Arizona and Arkansas has done so. In California, the practice seems well established, with 14 cities reporting that such maps have been made, 5 others stating the work is now under way or has been partly completed, and 7 having not done such work. Two cities in Colorado have made such maps, 3 are now working on it, or have it partly completed, and 5 have done nothing. In Connecticut, no city reported the work as complete, 2 have made some progress, and 10 have not started such a project. Of 12 cities reporting from Florida, only West Palm Beach has completed such maps, the water and sewer lines in 3 three others have been mapped, and 8 cities report no work.

Columbus and Moultrie, Ga., report the work is in progress; Thomasville will start such mapping "as soon as we can find a draftsman"; 4 other Georgia cities report no work done. Two of Idaho cities, Idaho Falls and Lewiston, report that they have made such maps. Of 32 Illinois cities reporting, 10 have made subsurface maps and 4 others have the work in progress or partly done. Only two of 17 Indiana cities have done anything on this, and in both of these work is incomplete. Three of 18 Iowa cities have completed the work and 5 others have it partly done, mainly having mapped the sewer and water lines. Three of 19 Kansas cities report that mapping is complete, and 4 others have the work partly done. Independence has mapped the sewers and is now working on water lines. In Kentucky, 3 cities have mapped subsurface structures, one has done some work, and 3 have not started. Only one city in Maine out of 5 reports any work of

CHECK YOUR EQUIPMENT  SNOW REMOVAL NOW

	NO. ON HAND	NO. NEEDED	ORDERED	DELIV. DATE
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ONE-WAY TRIP BLADE TYPE SNO-PLOWS				
PLOW ATTACHMENTS				
TIRES				
MOTOR TRUCKS				
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SALT				
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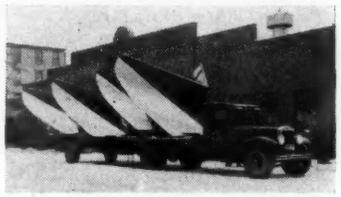
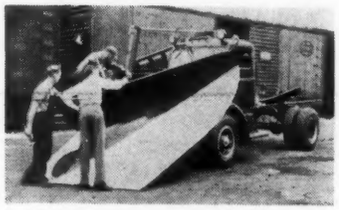


COME IN ALL SIZES



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When you need special information—consult the classified READER'S SERVICE DEPT., pages 67-69

this type. Portland having done it "in part." One of 2 Maryland cities has mapped its substreet lines. Of 20 Massachusetts cities, 3 have completed the work and 7 have it under way.

In Michigan, of 29 cities replying, 11 have complete maps and 4 have the work in progress. Of 30 Minnesota cities, 13 have complete maps and 5 others have the work well under way. Only one Mississippi city of 4 has done nothing; 2 have completed the work and one has it under way. Four Missouri cities have mapped subsurface structures, one has work under way; 14 have made no progress. One of 4 Montana cities (Forsyth) has a project 90% complete. One city in Nebraska (of 6) reports it is "making plans to do so." Sparks, Nev., has mapped its subsurface structures. Of 20 New Jersey cities, 6 have made such maps, and 3 have work in progress. In New York, of 40 cities 11 have completed subsurface maps and 10 have the work in progress or partly complete. Only 4 North Carolina cities have the work partly done; 7 report no progress. One out of 4 North Dakota cities reports mapping done or under way. Of 38 Ohio cities, 12 have subsurface maps completed, and 10 others have done some work. In Oklahoma, 2 cities have complete maps, 5 have the work under way and 5 report nothing done. Three of 5 Oregon cities have subsurface maps.

Out of 51 Pennsylvania cities, 11 have subsurface maps and 12 are working on them. Three of 6 South Carolina cities have mapped their subsurface structures. Only one of 6 Tennessee cities have done any of the work. Seven of 15 Texas cities have done such work in whole or part, and a couple of others are about to start. Two of 8 Vermont cities have completed subsurface mapping and 2 others have the work under way. In Virginia, 3 cities have completed such mapping, 4 have the work under way or have done some of it; 5 have done nothing. One Washington city has subsurface maps, one has done some work, and 5 report no progress. One of 5 West Virginia cities has completed such maps. Wisconsin cities have about the best record—of 23 cities reporting, 10 have completed subsurface maps and 8 have work in progress.

Russian Data on Soil-Asphalt

Soil-asphalt is the name given to a material obtained by mixing, in definite proportions, a suitable cohesive soil, previously dried at 190°C., with bitumen, heated to the same temperature. The mixing may be done in specially designed mixers or in an asphaltic concrete plant. The properties of soil-asphalt, which is carefully distinguished from stabilized soil, compare with those of asphaltic concrete, and it is recommended for either bases or wearing courses on roads carrying light or medium traffic, where aggregate is difficult to obtain. The process was first suggested in 1933, and a number of experimental projects have been carried out in the neighborhood of Moscow. These include cycle tracks and parks for cars and trolley-buses. The chapter headings of the book are as follows: I. Soil for soil-asphalt. II. Technological process and equipment. III. Laboratory design of mixes. IV. Laboratory experiments. V. Construction of road carpets from soil-asphalt, and their economic characteristics. VI. Future prospects.—S. O. GORDEEV : Moscow, 1944 (Dorizdat Gushosdora NKVD SSSR), 8 in. by 5¼ in., pp. 71, fig. 16, tab. 27, 4 roubles.—*Road Abstracts.*

Stream Sampling in Extreme Cold

By R. N. CLARK

Lt. Col. Robert N. Clark, at the time he underwent the experiences described below, was Chief Sanitary Engineer of the First Service Command, U. S. Army. Later he was placed in charge of Sanitary Engineering in the Ninth Service Command. He was separated from the Army last December and is now Chief Sanitary Engineer of the TVA.

IN connection with a stream pollution survey, it was necessary to collect a series of samples from Presque Isle Stream, Aroostook County, Maine. Several unexpected difficulties arose to hinder the project, and the solution of the problems may be of general interest, even though there are few localities blessed, or cursed, with as rigorous a climate.

In the first place, the survey had to be made in mid-winter (1944-45). The pollution load during the summer season had been pretty well defined, but during the winter, when the stream flow was low and an armor plate of ice prevented any appreciable oxygenation from the atmosphere, the condition of the stream was quite different, and worse. Consequently there was no alternative to sampling during the winter. The only choice was on the weather, whether to sample on days when the air was thick with snow, and cold, or when the sky was clear, and cold. We decided not to buck a blizzard, and chose clear weather. There was still another choice. When the air was clear and still, the thermometer was likely to sag to about 20° below zero. When the weather was clear and windy, the thermometer would climb to zero, or even to 10° above, in other words, quite mild for the locality, except that the wind was harder to bear than a still cold. As it turned out, the task of sampling was equally great, whether the weather was windy or calm.

It was very easy to choose sampling points from the map. However it was not so easy to get to the points chosen. It was decided to travel on skis, even though one of the party had never been on skis before and the others were very much out of practice. We thought that the going would be level and smooth, traveling as we planned, over the snow covered ice of the stream. At rapids we found it was very rough, and the banks were so rugged and drifted that it was difficult to get around bad spots on the river. Unexpectedly, we ran into patches of slush, which instantly froze to the skis, and had to be laboriously scraped off. The slush was formed at certain spots because the stream had frozen solid to the bottom, and the water was forced to flow over the surface of the ice, saturating the covering snow.

The first trip, which was in the nature of a preliminary reconnaissance, was the worst. On later collections we even had dog sledges (driven by members of the Arctic Search and Rescue Squadron, who were training dogs at the Army Air Base) to carry the tools and sample cases, and the party had become hardened to ski travel. On the first trip, though, each member of the party of six had a bulky, if not heavy, load. At the first location, two men went to work with axes to chop through the ice. The hole went down, one foot, two feet, and still the black ice was thick and solid. It was extremely difficult to kneel on the ice and chop two feet down, almost like kneeling on a desk

to chop at the floor. After penetrating thirty inches of ice, the choppers hit gravel, but no water. The stream was frozen solid to the bottom at that point. The next spot was more carefully chosen, over the deepest part of the channel, and once more the chopping began. This time the hole went down 34 inches before a sudden gush of water filled the hole. That stopped the chopping, because an axe is not good for chopping at the bottom of three feet of water. We tried ski poles, which rapidly coated with ice, and with difficulty enlarged the opening enough so that we could get our sampling tube below the ice.

We had rigged up some rubber stoppers and tubing so that we could suck water into a gallon sample bottle, the water flowing first through a B O D bottle, then through more tubing into the gallon container. We were depending on lung power to produce the suction in the larger bottle. The first effort produced a trickle of water in the B O D bottle which instantly froze to the glass sides. Also, instantaneously, the water in the tube froze solid, so that it would crackle when rolled between the fingers. A couple of men scraped the ice off the axe handles, and went in search of fire wood, while the others cleared the snow and ice chips away from the sampling hole, to prepare a place for a fire. The fire was built upwind from the hole, and was soon pouring a flow of heat, and smoke, over the scene of operations. In the meantime the surface of the hole had frozen over again. This time the bottles and tubing were kept above the freezing temperature, and the samples were collected as planned. Although insulated sample cases had been brought along, the cases and samples were warmed somewhat before packing, as an extra precaution against freezing. No samples froze during transportation.

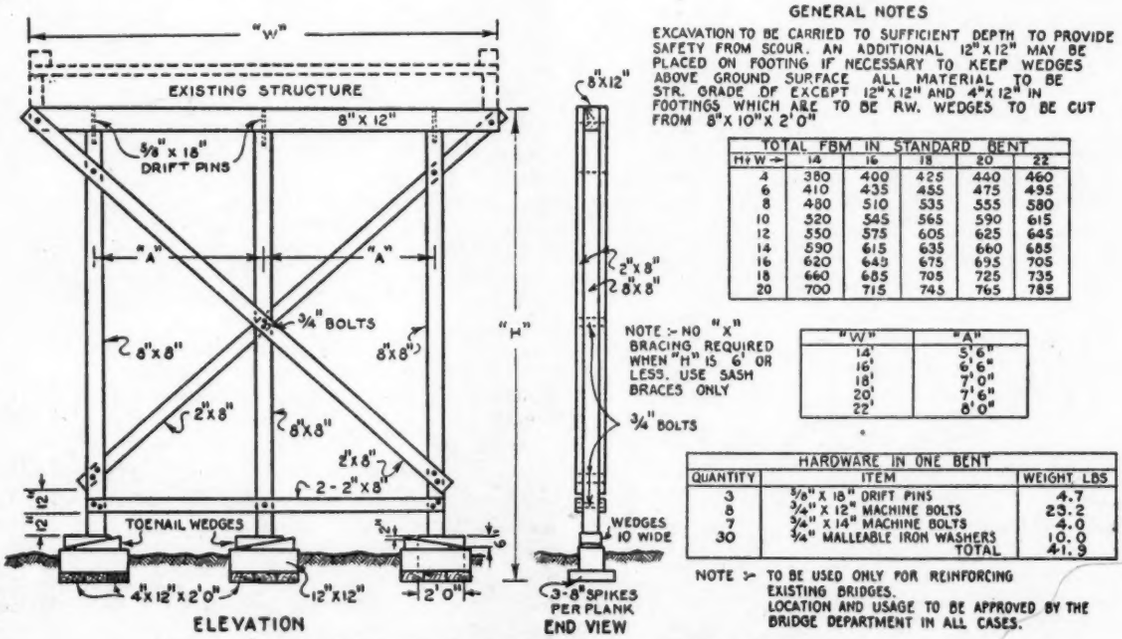
As a result of this experience, subsequent trips were equipped and run a little differently. An ice chopper was made from an old peavy socket welded to a broken file which was ground to a chisel point. Handles were cut on the site, to save carrying weight, and each handle was cut long enough to permit chopping through three feet of water. Also, a small shovel was added to the equipment to clear the hole of ice chips. The locations of sampling holes were chosen, not only with a view to water depth below the ice, but in spots where there was good snow cover, as the ice was believed to be thinner in such places. In every case, the entire party devoted its time first to the collection of wood, so there should be a good supply on hand for the indispensable fire. Once the fire was roaring, and the party could work with some degree of comfort, the samples could be collected, DO's set up, bottles warmed and packed, and the job completed with no more than the usual difficulty.

Words cannot describe several scenes; the picture of Capt. Vincent Hynes, wading to his knees in snow, with his skis over his shoulder, because it was easier for him than skiing; the pungent ejaculation of Stewart Donahue, Preque Isle water commissioner when his chopping brought up the first surge of hydrogen sulfide saturated water; the sandwiches frozen to the consistency of a dry sponge; the yarns beginning "this is nothing. You should have been here five years ago when it was so cold that. . . ." It isn't necessary to describe them. They were just a part of a successful undertaking.

Bridges - Reinforcement
x Bridge bent

Supplemental Bents for Highway Bridges

It is sometimes necessary to reinforce existing bridges, and for that purpose a timber bent may be placed under the structure, between existing spans. The illustration herewith, which is from the Manual of Instructions of the Maintenance Department, California Division of Highways, shows good practice. Tables in the illustration show board feet required for varying H (height) and W (width), the spacing A for various heights, the hardware in one bent. Details of footings are also shown.



GENERAL NOTES

EXCAVATION TO BE CARRIED TO SUFFICIENT DEPTH TO PROVIDE SAFETY FROM SCOUR. AN ADDITIONAL 12"x12" MAY BE PLACED ON FOOTING IF NECESSARY TO KEEP WEDGES ABOVE GROUND SURFACE. ALL MATERIAL TO BE STR. GRADE OR EXCEPT 12"x12" AND 4"x12" IN FOOTINGS WHICH ARE TO BE RW. WEDGES TO BE CUT FROM 8"x10"x2'0"

TOTAL FBM IN STANDARD BENT

H↓ W→	14	16	18	20	22
4	380	400	425	440	460
6	410	435	455	475	495
8	480	510	535	555	580
10	520	545	565	590	615
12	550	575	605	625	645
14	590	615	635	660	685
16	620	645	675	695	705
18	660	685	705	725	735
20	700	715	745	765	785

NOTE :- NO "X" BRACING REQUIRED WHEN "H" IS 6' OR LESS. USE SASH BRACES ONLY

"W"	"A"
14'	5'6"
16'	6'6"
18'	7'0"
20'	7'6"
22'	8'0"

HARDWARE IN ONE BENT

QUANTITY	ITEM	WEIGHT LBS
3	5/8" X 18" DRIFT PINS	4.7
8	3/4" X 12" MACHINE BOLTS	23.2
7	3/4" X 14" MACHINE BOLTS	4.0
30	3/4" MALLEABLE IRON WASHERS	10.0
	TOTAL	41.9

NOTE :- TO BE USED ONLY FOR REINFORCING EXISTING BRIDGES. LOCATION AND USAGE TO BE APPROVED BY THE BRIDGE DEPARTMENT IN ALL CASES.

Method of construction and materials required for a bridge bent.

Public Works Digests

Water Supply • Sewerage • Highways and Airports

In this section are digested and briefed the important articles appearing in the periodicals that reached this office during the previous month. Appended are Bibliographies of the principal articles, in which the articles in each periodical are numbered consecutively throughout the year, beginning with our January issue.

The letter and number at the end of each digest refer to those used in the Bibliography. Numbers not found in the current Bibliography will be found in the one published the previous month.

The Sewerage Digest

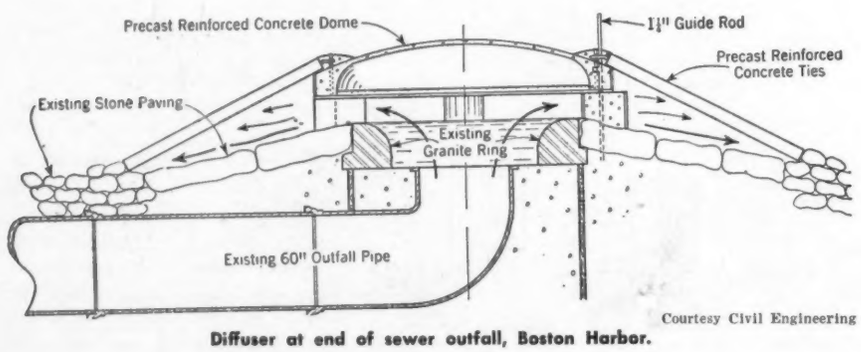
Boston Harbor Disposal Plant

(Continued from L3 in the July issue.) At each of the 6 sedimentation tanks are two take-offs from the conduit in the form of chimneys, into which grease enters from the top of the conduit and sewage and solids from the bottom, and from which the sewage enters the tank through four 24″ outlets and impinges on cross baffle walls. Effluent troughs at the outlet with V-notched crests total 288 ft. in length. Scum collectors discharge into cross collector channels 10″ wide, in which collectors convey it to sumps in three sludge and grease pumping stations, from which it is pumped to the digesters through 6″ pipes at 2.3 ft. per sec. Provision is made for passing a go-devil through these pipes when it is desirable to clean them. There are two primary digestion tanks with fixed covers and two secondary tanks with floating covers. At four points in each primary, provision is made for circulating hot supernatant through nozzles from above at 45° onto the scum, which can be drawn off at a point 3 ft. below the operating level. The sludge will be pumped, mixed with effluent, through a long 12″ line, to discharge in deep water in the early stage of each outgoing tide. Provision is made for cleaning this line also with a go-devil. Provision probably will be made for dewatering and drying 10% or less of the sludge for use as low-grade fertilizer on the parks of the Commission or of municipalities.

The plant effluent will be chlorinated by four 6,000 lb. chlorinators during the summer recreational season and then discharged through two 60″ outfall pipes into water 30 to 40 ft. deep, with a 90″ elbow pointing upward, surrounded by stone paving, and above which will be a flat dome 16 ft. in diameter, from the edges of which a large number of beams about 11 ft. long will radiate in all directions, the sewage discharging between them. This provides a fairly smooth mound over which a ship's anchor can drag harmlessly.[L4]

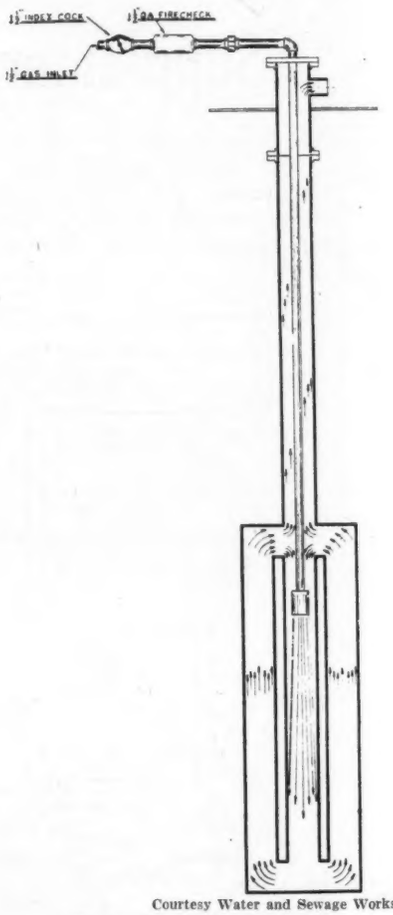
Heater for Sludge Digesters

A new method of heating sludge tanks has been developed at the treatment plants of Baltimore, Md., using submerged gas burners. The equipment consists of a carburetor and a gas burner of either the open or enclosed type. The carburetor mixes air and digester gas in the desired proportion and pumps it through a pipe to the burners. In the closed type burner, the gas mixture is discharged into a tube open at both ends, a little below its top, where it is ignited by an electric spark and the flame and burnt gases pass down



Courtesy Civil Engineering

Diffuser at end of sewer outfall, Boston Harbor.



Courtesy Water and Sewage Works

Heater for Sludge Digester

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Multdigestion System

gives you 3 big advantages

Advantages attending the use of this time-proved system of two-stage sludge digestion number a dozen or more—have led to several hundred installations, serving many millions of people both here and abroad.

Here, however, are the "Big Three" advantages—the major determinants in the continued wide-spread selection of a system that we have maintained in a state of continuous evolution and betterment ever since its inception many years ago.

• CAPACITY

Maximum sludge-digesting capacity per cu. ft. of a total tank volume.

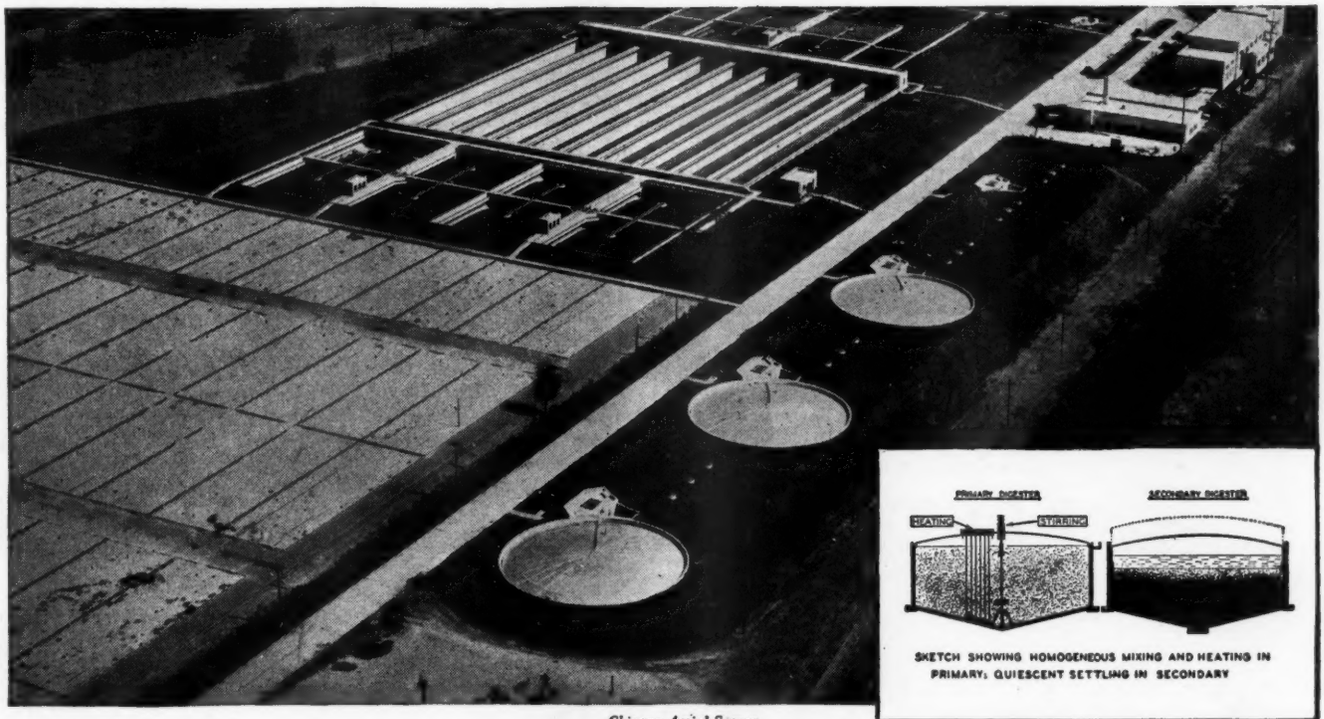
• REDUCTION

Average reductions of 40 to 50 percent of total solids; 55 to 65 percent of volatiles.

• GAS PRODUCTION

Average gas production of 15 to 20 cu. ft. per pound of volatile destroyed—1/3 or more greater than in non-stirred primary digestion tanks.

Write for complete information, including performance data under various conditions and with all types of sewage sludge.



Chicago Aerial Survey

Aerial view of three 90 ft. Dorr Multdigestion Systems at Gary, Ind. Fixed-cover primary tanks installed below ground level, alongside protruding, movable covers of secondaries, which appear as discs. *Consulting Engineers:* Alvord, Burdick & Howson, Chicago.

SKETCH SHOWING HOMOGENEOUS MIXING AND HEATING IN PRIMARY; QUIESCENT SETTLING IN SECONDARY

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through the tube and up through two parallel tubes connected to it at top and bottom, the exhaust gases being discharged into the atmosphere. A thermostat governs the gas input to prevent raising the sludge to too high a temperature. In the open type burner the flame and burnt gases are discharged into the sludge and there is no heat loss, and circulation of the sludge is caused; but the gas mixture must be discharged under sufficient pressure to more than overcome the hydrostatic head.[G15]

Sludge Chlorination For Density Control

Tenafly, N. J., treats its sewage by the activated sludge method, the waste sludge being vacuum-filtered and dried for fertilizer. To improve the sludge index, they applied chlorine at the rate of 1 to 3 ppm and in 8 days the Donaldson sludge density index rose from 0.43 to 0.89, when the chlorination was stopped, but the index continued to increase during the next 7 days to 0.94. Since March 1946 they have reduced the chlorine rate as the index improves. Experiment with rates up to 25 ppm did not seem to be more effective than 5 ppm, while it caused noticeable turbidity in the clarifiers. When used at 4 to 8 ppm it has never failed if started within reasonable time after the sludge index began to fall. Improvement is noticed in about 2 days and the desired results in less than a week. It is easy to operate; "we just turn on the chlorine and watch the index improve."[G16]

Effect of Sulphur In Sewage Plants

At the Aurora Sanitary Dist. sewage plant the hydrogen sulphide content of the sewage does not exceed 2 ppm, and that of the digester gas varies from 1.8 gr. per 100 cu. ft. to 99 gr., the 13 yr. average monthly content varying from 14.3 to 40.2 gr., varying inversely as the volume of sewage flow. As a test of the effect of this gas on metals, 17 samples of sash and door hardware of different compositions were placed about 2 ft. below the ceiling of the clarifier room, where the ventilation was sluggish and the humidity high and no heat was provided. The hydrogen sulfide concentration of the air was low, but only a few samples escaped serious corrosion. The samples included bronze nickel plated, chromium plated, sanded, dull, polished, and oil rubbed; cast-iron electro-galvanized, Bower Barff on cast iron, dull chromium, bright chromium, polished brass, dull brass, and plain brass and copper plate. The Bower Barff, electro-galvanized cast iron and polished bronze were only slightly affected. The others were more or less heavily corroded. Wrought iron pipes with standard brass valves carried the digester gas, and in ten years the copper was largely dissolved from the brass and the pipe lost 42% of its weight; the greatest effect being in that part of the pipe line between the digester and the drip pots, little effect being noted where the gas was not moisture laden. A 3-yr. test of 9 aluminum, 9 ferrous metal and 20 nonferrous metals exposed to moist gas led to the conclusion that all the aluminums, zinc and lead were free from attack. All copper-bearing alloys were attacked, but those with appreciable percentages of zinc were least so. All of the ferrous group showed losses, due partly to oxidation. Tin was not tested but it is believed that it would be unaffected. The severity of the attack on copper varied with the atmospheric moisture, being negligible in warm, dry atmosphere.[H35]

Sludge Gas Line Trouble

For three years, at Cortland, N. Y., there had been intermittent trouble with the sludge gas. Normally the floating gas holder and digesters operated with 6″ water pressure, but at times this rose to 12″, indicating that the gas line was clogged. Flushing it with water did not remedy it. This line enters horizontally near the bottom of the tank, with a moisture trap just outside the wall, and 14″ inside the wall it rises

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vertically to 2 ft. above the surface of the sludge, the elbow resting on a bracket. It was found that it had slid off the bracket and sagged, and the sag gradually filled with condensed moisture. Raising the sag 5" eliminated the trouble.[H38]

A Timber Outfall Sewer

In order to use local and available equipment, a 30" outfall sewer 250 ft. long for Asuncion, Paraguay, was made of Spanish cedar staves 2" thick, bound with steel hoops. At intervals of 8 ft., wooden flanges 4" thick surrounded the pipe to keep it circular. As the specific gravity of the wood was 0.65, a concrete counterweight was attached to the bottom by wiring it to the steel hoops. It was built complete on shore on greased ways, pulled into the stream, supported by five floats and moved down stream to where a trench had been dug for it in the stream bottom. It was lowered into this trench and covered with quarry stone.[E8]

Variable-Speed Centrifugal Pumps

Where variable speed pumping is necessary and the power source is alternating current, it is common practice to use wound rotor motors, multi-speed squirrel cage motors, or two-speed synchronous motors. The recently introduced magnet drive is claimed to be simpler and more dependable. It consists of a magnet, mounted on or coupled to the pump shaft, and a ring which surrounds the magnet and is mounted on or connected to the motor. The magnet consists of salient poles mounted on a spider and carrying field coils. The ring is of solid steel, the larger sizes carrying a laminated core and a cage winding. The torque is transmitted magnetically through the air gap between the ring and the poles of the magnet. Variable speed is obtained by varying the excitation to the magnet, which is supplied from a three-phase rectifier, by means of a potentiometer rheostat which controls the electronic tube output. The speed changes in a smooth line pattern over the entire speed range, not by jumps.[G17]

Controlling Sewer Odors

Chlorination of sewage in the sewers above a treatment plant controls the formation of hydrogen sulfide, 3 to 30 ppm being required, or 50% of the chlorine demand. Copper sulfate controls some of the micro-organisms which produce hydrogen sulfide. (In addition it kills roots in the sewer, which cause deposits.) Ferrous chloride is especially effective when the hydrogen sulfide concentration is already high. Chlorinated hydrocarbons, such as Chloroben, dripped into the trunk sewer in advance of the wet well inhibits organisms responsible for septic conditions in Imhoff settling compartments. Activated carbon has been used in settling tanks for odor control.[G18]

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Bulletin 35B.

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L *Civil Engineering*
4. Disposal Plant to Alleviate Boston Harbor Nuisance. By Karl R. Kennison. Pp. 304-307.

P *Public Works*
July
31. Infiltration Into Sewers. Pp. 25, 36.
32. Growth and Distribution of Film in Percolating Filters. Pp. 31-32.
33. Design and Capacity of Gutter Inlets. By N. W. Conner. P. 36.

BOOK REVIEW

Theory and Practice of Filtration. By George D. Dickey and Charles L. Bryden. 346 p. ill., Reinhold Publishing Corp., N. Y. $6.

This is a book that every engineer engaged in waste disposal or water purification ought to own and study; really the scope is much broader and includes the separation of solids from liquids and gases. The background of filtration and the theory and principles involved will provide an outlook to the student of this book that will make him a better engineer. And in Chapter 1, he will find an absorbing account of filtration through the ages.

Following the theory and principles of filtration, and its objectives, is a chapter on preparation for filtration, in which the three broad processes are listed: Classifying, thickening and settling; coagulation and conditioning; and filter aids and precoating. These procedures are discussed in detail. Following them are chapters on filter media; gravity filters; pressure filters; vacuum filters; hydraulic and squeeze presses; laboratory filters; oil filters, expellers and oil separators; water filtration, sewage clarification and sewage sludge dewatering; centrifugals and centrifuges; air, gas and light filters; auxiliary equipment; typical filter installations and flow sheets; testing and selection of equipment; and installation and operation.

An appendix, by John M. Walker, treats "Surface and Interfacial Tension Separation of Immiscible Fluids." Thus, the tiny holes or capillaries extending through a membrane or thin wall of porous material may be filled with liquid plugs which do not permit passage of another immiscible liquor or gas until a considerable pressure is reached, but do permit the flow of the same or similar liquids at any pressure difference. A familiar example is the separation of water from gasoline by a chamois skin.

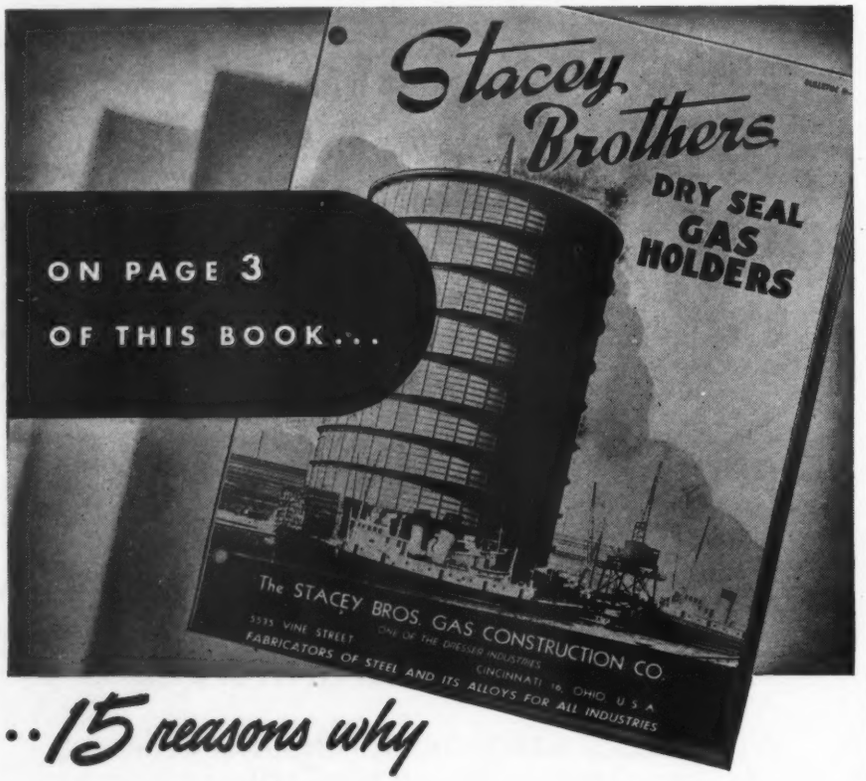
This book is almost required reading for the man who wants to know all about his job when that job includes filtration. It isn't too easy reading. There are slips here and there in spelling and in names and initials; but it still ought to be in your possession and close enough for study, reference and acquisition of new ideas.

(Reviewed by W. A. HARDENBERGH*)*

Alabama Water and Sewage Operators Meet

Representatives from eighteen Alabama municipalities, 78 in all, attended the first short course for sewage and water operators in Auburn on May 22-25. Arranged through the cooperation of the Alabama League of Municipalities, the State Department of Health, the University of Alabama and Alabama Polytechnic Institute, the meeting brought together water works ssuperintendents, sanitary engineers, filter plant operators and representatives from industry. During the conference, problems faced by these men on the job, discussions on topics of importance to sewage and water works operators, field trips, and visual education by means of motion picture were stressed.

W. W. Pointer, superintendent of Public Utilities, Troy, was elected president; W. H. H. Putnam, Assistant Manager, Birmingham Water Works, vice president; Alex O. Taylor, Director, Engineering Extension Service, A. P. I., Auburn, secretary, and Prof. G. H. Dunstan, Professor of Sanitary Engineering, University of Alabama, treasurer. Committees appointed and chairmen are: program, C. W. White, Assistant Sanitary Engineer, State Department of Health, Montgomery; constitution and by-laws, A. O. Norris, Manager, Birmingham Water Works; membership, Tom H. Collins, Manager, Ozark Water Works; and industrial, Edward L. Gilder, Sales Engineer, American Cast Iron Pipe Co., Birmingham. Arthur N. Beck, Assistant Sanitary Engineer, State Health Department, will edit the semi-monthly magazine.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The Waterworks Digest

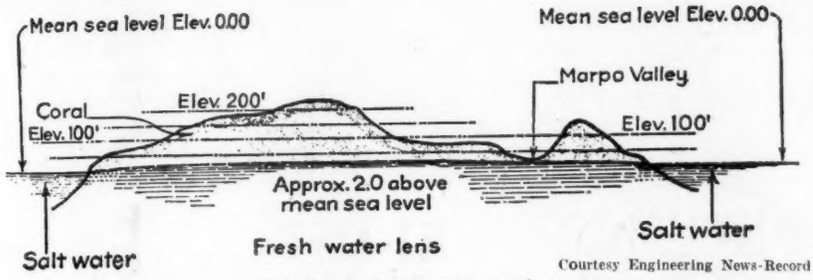
Skimming a Water Supply on a Coral Island

Tinian Island, in the Pacific, is largely formed of coral which is very porous and all rain water soaks quickly to sea level, where it floats on the sea water which permeates the island, standing 1.6 ft. above sea level, indicating a depth of fresh water of 64 ft. Actually only a few feet of this depth is potable (less than 400 ppm of salt). To confine removal of water for a water supply to these few feet, a double intake gallery 300 ft. long was laid 3.6 ft. below static water level and yielded 2 mgd of water with a salt content not exceeding 100 ppm, or 4 mgd with 115 ppm of salt. The intake tubes were made of steel bomb crates 20″ in diameter, perforated with ¼″ by 1½″ holes spaced 2″ apart, which were surrounded with 1½″ crushed coral to 8″ above the tubes, the rest of the trench being filled with a clay seal.[E17]

Metered Water Rate Schedules

The author believes that water "should be sold on equal terms to all customers, large or small. This service is just as essential to the large customer, and mere volume of consumption should not for that reason be given undue consideration." The water industry does not need to find a market for its product but rather how to meet the demand for it. Equity will be best served by 1. A proper ready-to-serve, or demand, charge based on the potential quantity that may be demanded or required. 2. A consumption charge that requires each consumer to pay for what he gets, be the volume small or large. 3. The abolition of all special concessions of whatever nature and all discriminations between individuals or corporations.

Discussing this paper, C. H. Capen said that most waterworks men favor a separate and distinct ready-to-serve charge, but the public has an intense dislike for such a charge, and it seems to be better policy to call this a minimum charge, which would include the use of a certain amount of water. He is strongly in favor of no free water to any consumers, public or charitable. But he does not agree that the price should be the same for all consumers, large and small; it should not be sold at less than cost, but a large consumer can be served at a lower cost than a number of scattered residences and should be given the benefit of the fact. Said M. F. Hoffman: "The commercial costs alone (meter reading, billing, collecting and accounting) comprise a large part of the domestic customers' bills. Since comparatively few, or about 2%, of all customers account for 50% of water revenues, and so entail considerably less overhead, they should be entitled to a lower rate. This is not a subsidy; it is good business."[A92]

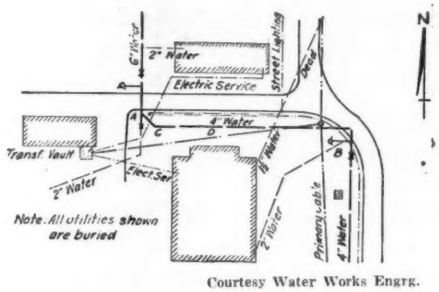


Courtesy Engineering News-Record

Skimming a fresh water supply.

Locating Pipes At Army Posts

In the older Army posts the water pipes were not laid in the roads and there may be no surface evidences of their location such as valves or hydrants. In some posts there are three separate distribution systems; and in many there are no dependable records of pipe locations. Service Command engineers are engaged in remedying this by locating and mapping the pipes. For this they use dip needles, pipe energizers and electronic devices. The last named device is found most useful in the Second Service Command, (for which the author is engineer) and by means of it any buried pipe, cable or metallic body can be located and its depth determined. It is used inductively or conductively for finding pipes and tracing them; and with a radio balance hook-up it is used principally to locate valves, manhole covers and other buried objects. With the conductive method, used where there are hydrants or valves to which it can be connected there is less interference than with the inductive. Such interference may make the locating of a pipe very difficult, the accompanying sketch illustrating one instance. Here the pipe was located down to A at the left and up to B at the right; after much difficulty it was picked up between C and D and traced in both directions by the inductive method. Finding pipes, valves and manhole covers is very difficult under reinforced concrete and some types of bituminous pavements, in wet sand or cinders, and in proximity to large metallic bodies such as railroad tracks.[F50]



Courtesy Water Works Engrg.

A water line that was hard to locate.

Obtaining CO_2 from Flue Gas

Tampa, Fla., formerly obtained CO_2 for recarbonation by burning coke in a furnace, but in its rebuilt plant it obtains it from flue gases in the boiler room by connecting a cast iron pipe line to the flue and passing the gas through two scrubbers and drawing it to the filter plant 200 ft. away by means of two rotary compressors. This saves a great deal of expense for coke and is far cleaner. The scrubbers consist of 36″ c.i. pipes containing clay scrubber tile, through which the CO_2 rises while water, sprayed over the top of the tile, descends to the bottom drain.[J12]

Dichotomosiphon Tuberosus at Chicago

This is a species of algae said to be rare, but which at times form a heavy mat on the screens at the Chicago filtration plant. The screen area is 3,000 sq. ft. of ⅞″ openings, which would seem to be large to give clogging trouble. The material is tough; some of the fibres are 2″ to 3″ long. The most effective method of removal was by blowing compressed air through the screen. Clearing the 33 screens required 24 to 48 hr., when it was almost time to start again.[G32]

Methods of Corrosion Control

Of all treatments of industrial waters for inhibiting corrosion, calcium carbonate scale is the most widely employed. But while it stops corrosion, the heavy deposit causes greater loss of heat transfer (when used in industrial plants for cooling) than would the corrosion products. Among the difficulties experienced in using it are failure to form calcium carbonate; the scale is soft and porous; formation of excessive thickness of scale on hot surfaces and none on cold. The last can be controlled by proper adjustment of the relations between pH and alkalinity. Corrective measures for the first two are avoidance of the use of water containing turbidity, oil or organic inhibitors; chlorination to oxidize such inhibitors and eliminate algae and slime; omission of phosphate salts and organic compounds; and proper selection and feeding of chemicals.

When it is not permissible to add chemicals, vacuum de-aeration may be a practical corrosion corrective measure. De-aerators may be single or multiple stage. The water falls over a succession of slats in a vertical steel tank in which a partial vacuum is maintained by vacuum pumps or otherwise. By this means the oxygen content can be reduced to 0.2 ml per liter, and the CO_2 to 1 ppm. The cost of the equipment is high but that of maintenance and operation is less than for chemical de-aeration or some of the corrosion inhibitors.

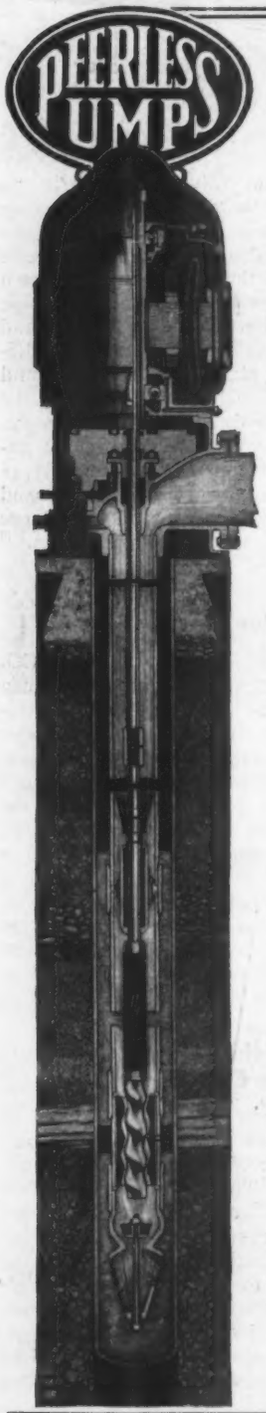
Small doses of polyphosphates are effective in controlling scale and inhibiting corrosion which may result when deposition of scale is prevented, but may not be satisfactory when soft water has temperatures of 180° or higher, but in such case 12 ppm of sodium hexametaphosphate has proven satisfactory. Properly controlled lime, high doses of polyphosphates or sodium silicate will greatly mitigate corrosion and prolong the life of ferrous metals exposed to soft corrosive waer.[A90]

A New Concept Of Coagulation

What the author calls the protogel theory of coagulation is based upon the theory that, when sodium silicates are dispersed in water, the silica can be released and allowed to develop into particles of colloidal dimensions, which development continues until a firm gel is produced. Colloidal particles of suficient size interlock physically or their fields of force become interactive (hence "protogel," signifying the lowest in a series of gel structures). The protogel thus shrinks and separates into small flocs. It is conceived that the whole of the water is, at one time, within the protogel structure, and passes out through its pores or capillaries, leaving within the flocs any micro-organisms present.[G33]

New Meter Specifications

The Meter Committee of the A. W. W. A. has nearly completed new specifications for water meters, their work on them having been interrupted during the war. They decided not to include limits of sensitivity and noise, as there are too few definite data on which to base them. Also they omitted items which would increase the cost of manufacture without corresponding increase in effectiveness, such as tin coating, 250 psi pressure test, coloring register hands, etc. The specifications provide for a new thread on the meter connections which will allow interchangeability among meters of different manufacturers. They provide for the same sizes of meters as the 1921 specifications. The "Registers" and "Intermediate Gear Trains" sections have been rewritten and amplified and oil-enclosed gear trains are included. Other new provisions are maximum speed of the pistons and standard over-all lengths of displacement meters; but it was found impossible to fix standard lengths for current and compound meters. For current and compound meters the permissible loss of head was changed from 25 psi to 20 psi, and accuracy at minimum test flow rates from 90% to 95%.[A93]



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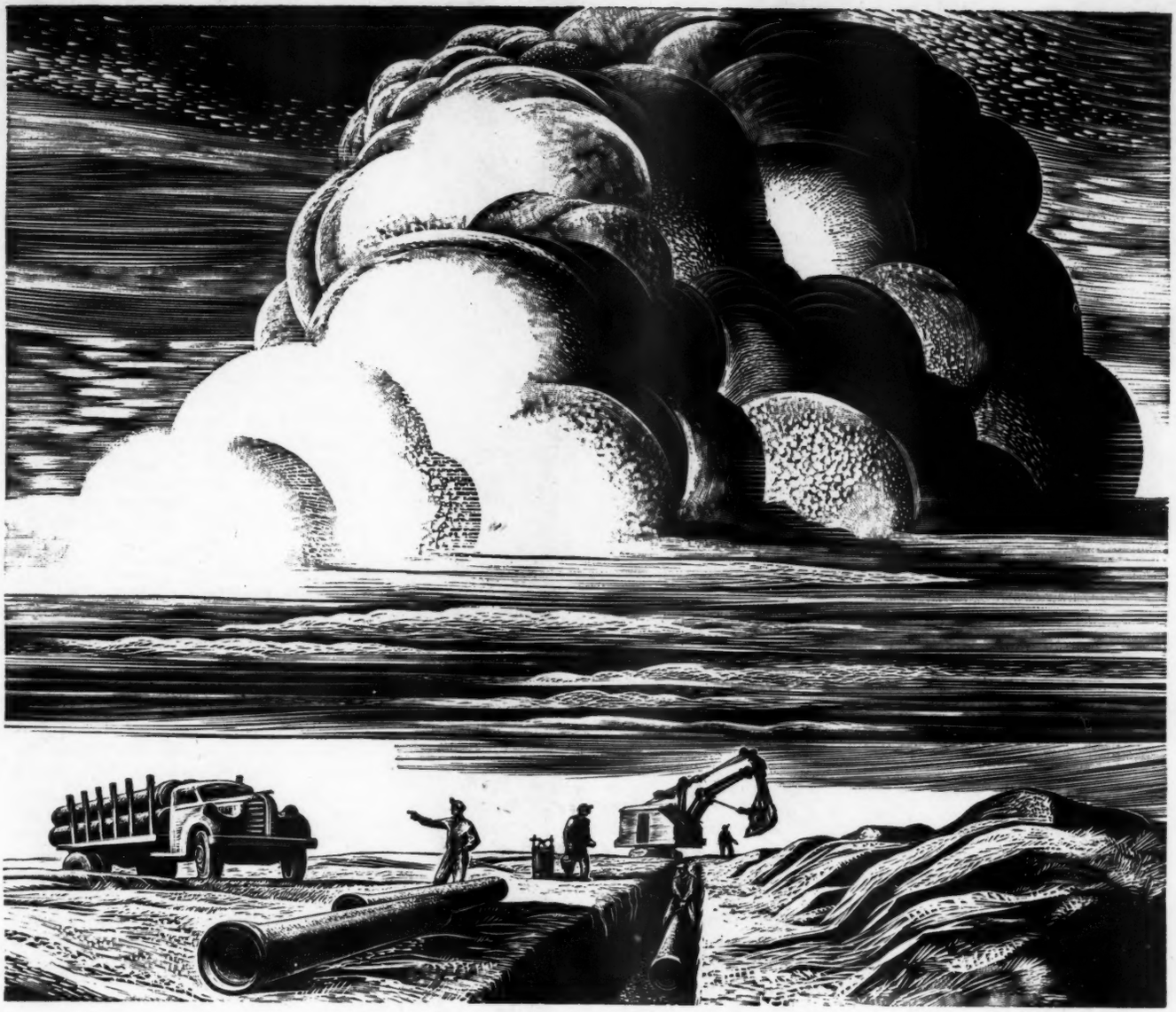

Original Woodcut by Lynd Ward

When a growing community decides to construct a supply line to tap new sources of water supply, it plans for future as well as present needs. It is logical, therefore, that long-lived cast iron pipe should so frequently be given the preference over other materials, even at a higher first-cost. For this type of construction should be permanent construction. The pipe should be bought once, laid once, and cost little or nothing to maintain. U. S. Cast Iron Pipe, in supply line service, has been meeting these requirements for many years in all parts of the country.

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Chlorine for Poliomyelitis

Investigations have showed that poliomyelitis virus is decidedly more resistant to the germicidal effect of chlorine than are most bacteria; but recent ones show that 'chlorine is an effective inactivating agent for the Lansing strain of poliomyelitis virus if related to the actual free or uncombined chlorine residual in solution, and not to the total available residual chlorine" in a heterogenous mixture of chlorine and chloro-compounds. It was found that a "free" chlorine residual of approximately 0.2 ppm, by OTA, will inactivate a 1:500 dilution of the virus after a 10 minute contact period; and 0.1 ppm with 30 minutes contact.[X10]

Automatic Sprinklers

The design of an automatic sprinkler system is based on standards of the National Board of Fire Underwriters. For 250 sprinklers or less, the water main supplying them should be able to deliver 500 gpm with 15 lb. pressure at the highest sprinkler; but for buildings of light hazard occupancy, 250 gpm is permissible. If the municipal main does not have this capacity and pressure, a fire pump of 500 gpm or a 30,000 gal. gravity tank is required. An outside connection for fire department pumpers is usually required as an auxiliary. The connection with the main must be at least 6" pipe for 250 sprinklers, a larger size for a greater number.

The wet-pipe sprinkler sytsem is usually installed where there is no danger of freezing, the dry-pipe in unheated buildings. The latter system stands full of air, and it may take an appreciable time after the sprinkler heads open before the water drives out the air and sprays from the heads. Out of 12,000 fires in sprinklered buildings, wet systems were 97.4% efficient and dry systems 92.1%.

A sprinkler system uses much less water than the fire department would in extinguishing most fires. "The best way to insure a lessening of demands upon your plants is to encourage the installation of private fire protection, by showing leniency on service charges."[V9]

Cut-Off Trench For Earth Dams

U. S. Army Engineers have developed a method of preventing both through seepage and under seepage in earth levees and dams by digging a deep cut-off trench and filling it with puddled clay; the important construction feature being the filling of the trench with clay slurry while excavating it, whereby there was no sloughing of the walls while digging a trench 35 ft. deep through alluvial soil or sand by trenching machine and dragline. A trench filled with genuine puddle is superior to concrete as a cutoff since the material itself is less pervious and cracks through it are practically unknown. It would cost less than a steel sheetpile cutoff of equal depth.[E15]

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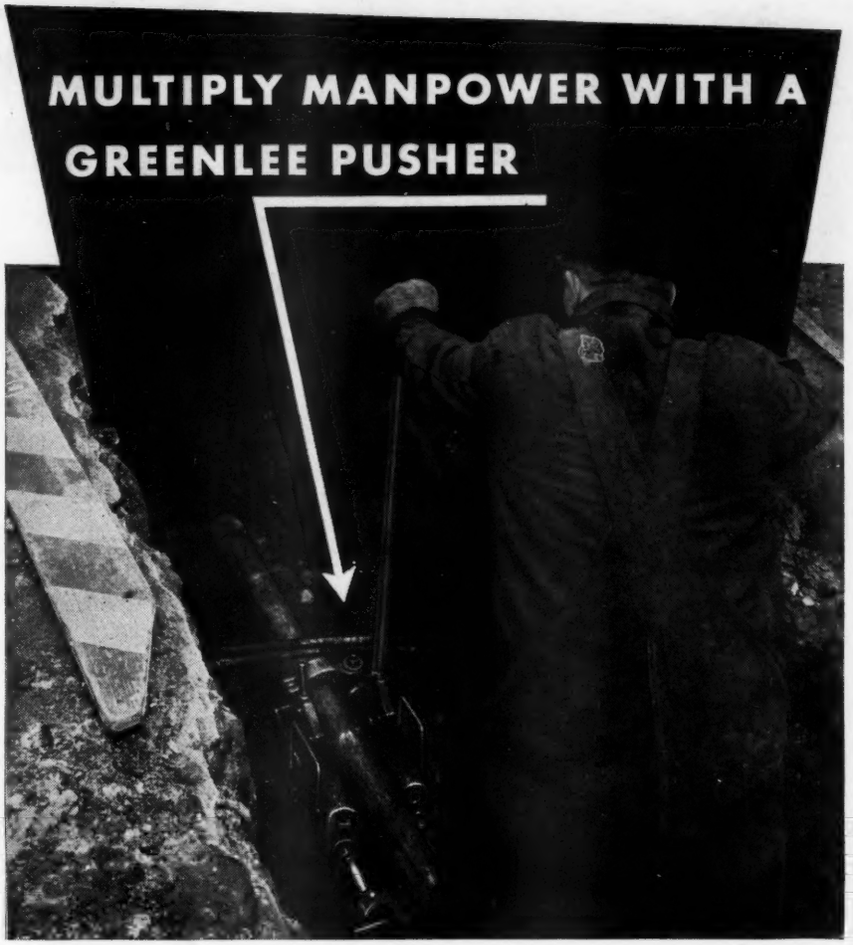
10. Inactivation of Poliomyelitis Virus by "Free" Chlorine. By G. M. Ridenour and R. S. Ingols. Pp. 639-644.

Permutit Test Kit Simplifies Boiler Feed Water Analyses

The testing of boiler feed water for hardness, alkalinity and chloride content is readily accomplished with a new boiler room test kit made by the Permutit Company, 330 West 42nd Street, New York 18, N. Y. The kit, containing solutions and precision-made pipette droppers for accurate measurements, comes in a portable white enamel cabinet, 10"x10"x 4¾". It can be modified to permit the testing of sodium sulfite in boiler water.



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. . . for all they do is "screw 'em together." No expensive equipment. No weather handicaps. No skilled labor. No slow motion. And how that cuts installation time and costs!

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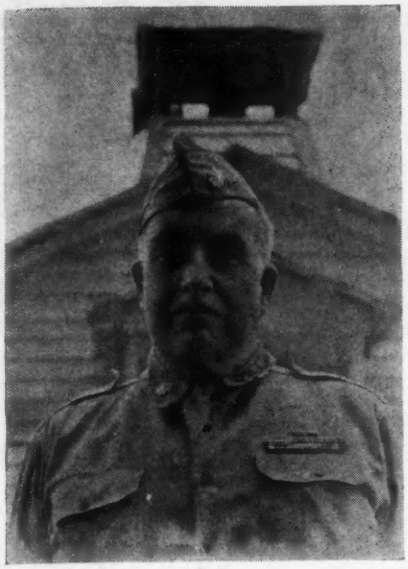

A recent photo of Col. Jack J. Hinman, sent from Japan to the Editor of Public Works.

Technical Booklets

Drinking Water Standards, USPHS, 1946.—These standards supersede those adopted in 1942 and cover (1) definition of terms; (2) source and protection; (3) bacteriological quality; and (4) physical and chemical characteristics. Reprint No. 2697 from Public Health Reports, Supt. of Documents, Gov't Ptg. Office, Wash., D. C., 5 cents.

Materials for Safety Wearing Apparel.—This is a publication of the Dept. of Commerce and is for sale by the Supt. of Documents, Wash., D. C., for 5 cents. It gives material specifications and methods of tests for asbestos, cotton and woolen fabrics, leather and accessory materials. Commercial Standard CS129-46.

Thickeners, Clarifiers and Filters.—Thickening, clarifying, and agitating equipment are covered in a new sixteen-page bulletin issued by the Hardinge Company, Incorporated, York, Pa. The catalog is well illustrated and covers thickeners, clarifiers, and agitators, including tray thickeners, "Auto-Raise" thickeners, rectangular clarifiers, circular clarifiers, agitators, hydro classifiers, hydro separators, counter current classifiers and automatic backwash sand filters. Two tables are included in the bulletin, which give data on specific thickening and clarifying operations. Copies of this bulletin 31-D may be secured from the Hardinge Company, Inc.

Builders-Providence Equipment

Builders-Providence has issued a new folder with brief descriptions of differential producers, filter controllers, propeloflo meters, flo-watch, chronoflo telemeters, filter gauges, dial gauges, flo-gauges, manometers, meters for open flow, conveyor scales, ratio indicating gauges and other auxiliary equipment. A handy compact summary. Write Builders-Providence, Inc., Providence, R. I.

Worthington Supplies Engines for Nut Island Sewage Treatment Plant

Contract for engines for the Nut Island Sewage Treatment Plant project, Quincy, Mass., designed to eliminate the pollution and objectionable sewage disposal conditions that have existed on the South Shore of Boston, has been awarded to the Worthington Pump and Machinery Corporation. This project, which is under the direction of the Metropolitan District Water Supply Commission, will be capable of handling over 250,000,000 gallons of sewage per day. The contract calls for four Worthington Dual-Fuel engines that will operate interchangeably, without shut-down, on either Diesel oil or fuel gas, or in any proportion of the two. In the Quincy plant, sludge gas, reclaimed from sewage treatment will be utilized.

The Worthington Dual-Fuel engines, coupled with a straight gas engine-driven generator unit, will furnish power which will be used to drive motor-driven sewage pumps consisting of four vertical 48" pumps with 54" suctions.

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In any Mathews Hydrant the operating thread is permanently dry and dirt-free, a point we cannot overstress. The stuffing-box plate is so designed as to prevent contact between the thread, and water in the hydrant. As for rain, that is kept out by means of an iron shield capping the bronze revolving nut. This cap also excludes sand, dust and dirt. The result is an operating thread that can be depended on to work perfectly.
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A hydrant so superior might be expected to be widely favored. That is the actual case, and today there are some 400,000 Mathews Hydrants in use, everywhere in the world.
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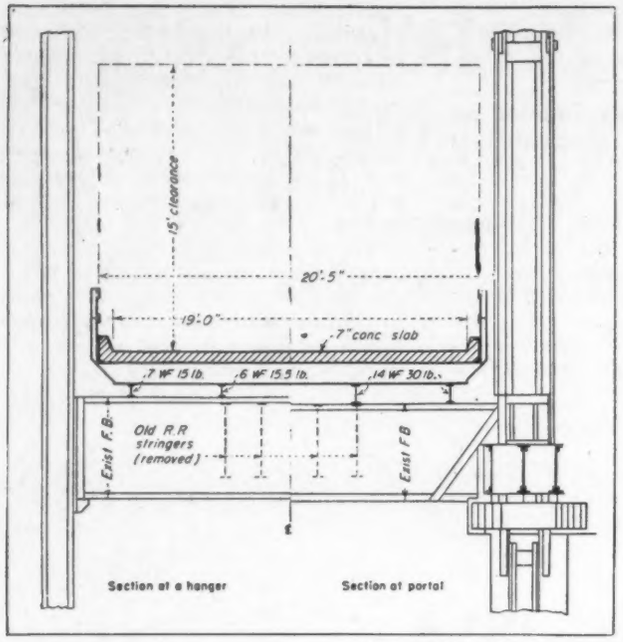
The Highway and Airport Digest



Courtesy Engineering News-Record

Redecking converts railroad to highway bridge, Toprock, Ariz.

Converting R. R. Bridge For Use as Highway Bridge

As a joint project of the state highway departments of Arizona and California, plans have been adopted for redecking a single-track railroad bridge (given to the states by the Santa Fe Railroad) to be used as a highway bridge, replacing one a short distance down stream which is only 17 ft. wide; while use of 2 or 3 miles of the old railroad road bed will provide better grades and alignment than the existing highway.

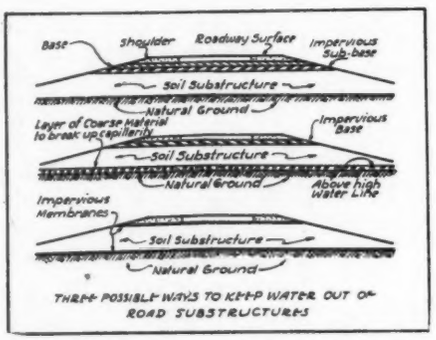
The new bridge roadway will be a 7" reinforced concrete slab 19 ft. wide between 9" curbs, resting on floor beams and sub-floor beams, which in turn rest on the existing floor beams; designed for H-15-S12 loads. The bridge is 990 ft. long. Contract for the reconversion was let for about $60,000.[E25]

Drainage Fundamentals

Money spent for adequate drainage can be more than compensated for by reducing the thickness of the pavement. Road drainage is classified as subgrade, base and pavement, shoulder, side ditch, cut slope, fill slope, cut-fill point, slide and slip, and side road drainage. Subgrade drainage can be effected by side ditches, under-drains, interceptor drains, or subgrade treatment. If the subgrade soil is retentive of water, drains may not remove all of this for a long time, and three remedies are suggested—replace the pavement over such areas with temporary traffic-bound material, to be replaced when the subsoil has dried out; or repave the area with a pavement having sufficient strength to distribute the load adequately; or make the entire pavement water-tight and cover it with 18" of thoroughly compacted soil and repave on top of this. To protect slopes on both cuts and fills, encourage the growth of ground cover. Where a cut ends and fill begins, a paved spillway should be provided.[N50]

Supporting Power Of Clay Soils

The denser a clay soil, the greater its rupture load. The compaction loading to obtain maximum density must be fitted to the moisture content of the clay; too heavy a load may give less strength than a lighter one if the clay is wet. Having obtained maximum compaction, later increase in water content will reduce the load-supporting power of the clay and also cause it to bulk, causing irregularities in the surface. This may result from the compacted clay remaining uncovered before the wearing surface is laid, from water entering through cracks in such surface, or from subsoil water entering from the sides or from below by capillary attraction. These should be prevented by covering the clay with an impervious membrane, by keeping all pavement joints and cracks filled, by sub-surface drainage, or constructing a cut-off between the natural ground and the compacted clay by a waterproof membrane or a layer of gravel. The elastic limit of a compacted integral clay is well defined and can be determined in the laboratory, and the working unit stress should not exceed 50% of this.[N49]



Courtesy Roads & Streets

Three ways to keep water out of a road substructure.

Soil Cement Landing Mat

In building a landing mat for coastal patrol blimps at Hitchcock, Tex., 450,000 sq. yd. of the base was made of soil-cement 6" thick, which was covered with a wearing course of 1½" cold-mixed asphaltic concrete. The soil-cement was a mixture of pit-run sand-gravel containing a relatively high proportion of clay, and three sacks per cu. yd. of portland cement and a total water content of 8%. This was mixed in a 5,000 lb. and a 3,000 lb. pug mill and was spread 8" deep between timbers 20 ft. apart and compacted to 6" with 10-ton three-wheel rollers. Alternate 20 ft. lanes were constructed first and, after these had set for a week, the intermediate lanes were constructed. The soil-cement mixture was spread by means of a special box at the front end of a tractor-bulldozer, which box consisted of a bulldozer blade with attached side wings 10 ft. apart mounted on sled shoes which traveled on the subgrade and held the blade 8" above it. The rolled base was sealed with a prime coat of RC-2 cutback asphalt, which also served as a tack coat for the asphaltic wearing surface. Load tests and cylinder tests indicated that the soil-cement base was equal in compressive strength to 2500 lb. concrete.[87]

Overpassing a Traffic Circle

The largest traffic circle in New Jersey, built in 1925, has an inside diameter of 300 ft. and a 40 ft. roadway. It serves four highways and a daily traffic averaging 58,000 and peak of 90,000, which swamps it. To relieve it, a triangular or Y overpass is being built, the stem of the Y connecting with Admiral Wilson Blvd. and the branches connecting with No. 38 and No. 45. Traffic can use either the circle or the overpass, as it chooses. The latter will be for one-way traffic only, the direction being changed from time to time to accommodate the predominating traffic.

The overpass is constructed as an embankment except where it crosses the circle roadway, where bridges are constructed 14 ft. above that roadway. The pavement is 34 ft. wide, of 10" concrete, not reinforced because of material shortage. Contraction joints are spaced 14 to 19 ft. apart, with slots 1¾" high at the bottom and 1¾" deep at the top. Several hundred ½" round brass plugs are set into the concrete near joints to permit future study of vertical and horizontal movements.[N48]

Airport for a Small Town

Crawfordsville, Ind., with a population of 1,000, owns an airport in charge of a manager. It purchased 160 acres of rolling farm land which required no grading, and contained a barn which is used as a hangar and tool shed. A released army flier is manager, under a contract by which the town furnishes the field and a laborer and the necessary maintenance equipment, while the manager furnishes three light airplanes and qualified instructors, receiving remuneration from instruction, carrying passengers and charter trips.[J18]

Cracks in Concrete Pavements

In Quebec, maintenance records show that the expansion joints cause most of the troubles in concrete pavements; they can not be kept water tight, and the infiltering water softens the base. The author favors spacing expansion joints 200 ft. apart and contraction joints 40 ft., grooved to a depth of 2". A cause of longitudinal cracks has been frost heaving. Steel reinforcement was placed at the bottom of the slab and is useless in preventing cracks, but would be much more effective if placed at the top of the slab.[O39]

Tourist Money for Highway Funds

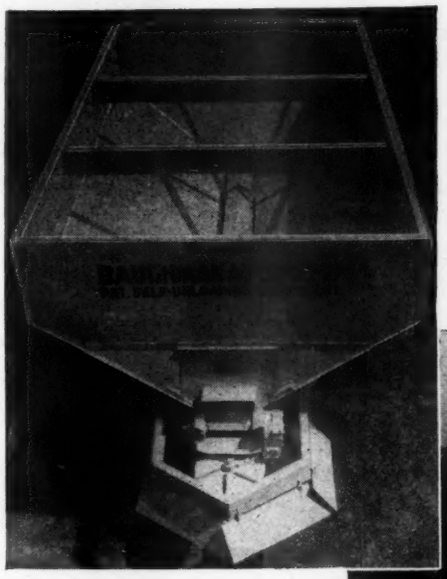
Many states advertise their tourist advantages and take in millions of dollars, mostly from automobilists, of which that obtained by gasoline taxes should be used on the highways. Vermont's tourist business in 1941 was valued at $40,000,000. That of Maine in 1937 was $105,000,000. South Dakota in 1937 received $175,000 for tourist gasoline taxes. In 1941 tourists spent $415,000,000 in Pennsylvania; $51,000,000 in Oregon, and $350,000,000 in Florida.[R22]

Salvaging Old Concrete Pavement

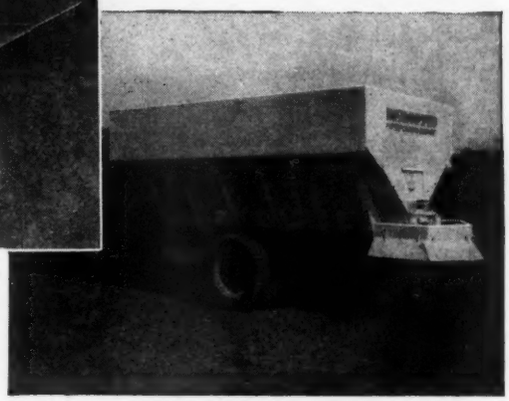
Delaware State Highway Dept. built a 16-ft. concrete highway in 1918, widened it to 20 ft. in 1927, and last year added a 4-ft. strip along one side, patched less than 5% of the total area, and covered the entire 24 ft. with 3" of hot-mix asphaltic concrete, the 8.6 mi. so treated costing $168,000. Adding the 4 ft. to one side was preferred to two 2 ft. strips as costing less and promising less trouble from movement of the strip. The old pavement had no expansion or contraction joints, which was thought to contribute to its excellent service.

In constructing the new strip, a 5 ft. trench was excavated with a motorized patrol grader. The concrete consisted of portland cement, sand and crushed stone, mixed 564 lb., 1215 lb. and 2202 lb. for the widening, and 647 lb., 1073 lb. and 2160 lb. for the patching, with 5.5 gal. of water per bag of cement. The strip was made 8" thick, unreinforced. A finishing machine rode on the edge of the old slab and outside steel forms. Finishing was followed by hand floating, and curing with a 2% solu-

Spreads Cinders Efficiently in Sub-Zero Temperatures



The BAUGHMAN Special "K" Model Cinder Spreader gives top performance under *all* weather conditions. Built-in heater prevents water in cinders from freezing . . . keeps mechanism warm as well. Result: a free-flowing, efficiently-spread load.



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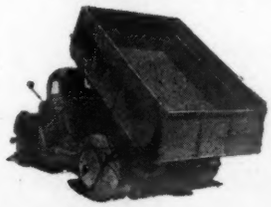

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tion of calcium chloride and wet burlap. Results are so satisfactory that 57 additional miles are to be treated similarly.[E23]

Asphalt Jacking California Pavements

Following 1931, mud jacking was employed in California for leveling up concrete pavements. In 1944-45 some districts experimented with heated asphalt instead of mud, and this was so satisfactory that it has replaced mud jacking in that state this year. At first, air-blown asphalt having a penetration of 50-60 and 30-40 was used, but this extruded in summer and now 20-30 air-blown asphalt is used instead.

Holes 1¼" or 2¼" diameter are drilled through the pavement using portable air compressors, and if any water is found under it, this is blown out. The asphalt, heated in portable kettles to between 325° and 400° F, is pumped at 20 to 40 lb. pressure, through a 1" or 2" hose and a nozzle. The 1" nozzles are tapered and driven into the hole and held there by a man standing on an attached plate. The 2" nozzles are expanded by screw pressure to fit the hole tightly. When asphalt exudes through cracks or the slab starts to rise, the nozzle is removed from the hole and a wooden plug driven into it. The heating kettles have capacities of 165 to 400 gal., but a crew of 6 to 8 men will use 800 to 1100 gpd, and the department shop is converting two 1040 gal. water tanks into oil-heating tanks. The crews average 100 to 130 holes a day, using 5 to 15 gal. per hole. The cost averages $2.50 per hole.[W12]

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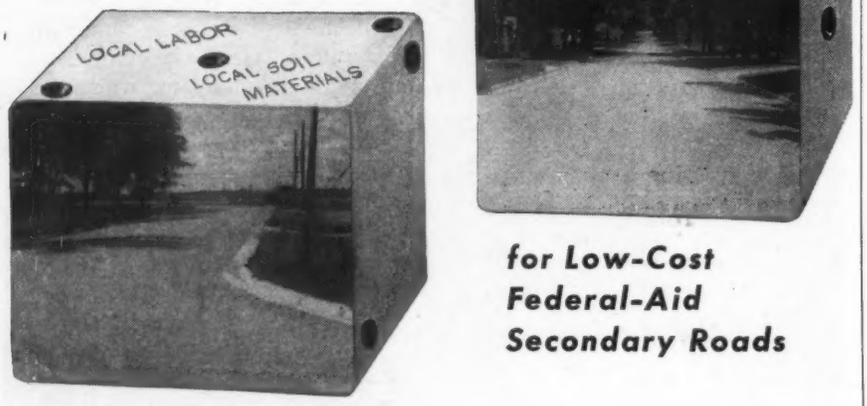

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D *The Surveyor*
June 14

23. Road Signs and Markings. By J. O. Martineau. Pp. 463-464.

E *Engineering News-Record*
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21. Elastic Limit Basis for Designing Highway Substructures in Clay Soil. By Henry C. Porter. Pp. 92-93.

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22. Tests of Flexible Pavement for Airport Runways. Pp. 88-92.
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24. Reducing Unknowns in Small Culvert Design. By F. T. Mavis. Pp. 103-104.
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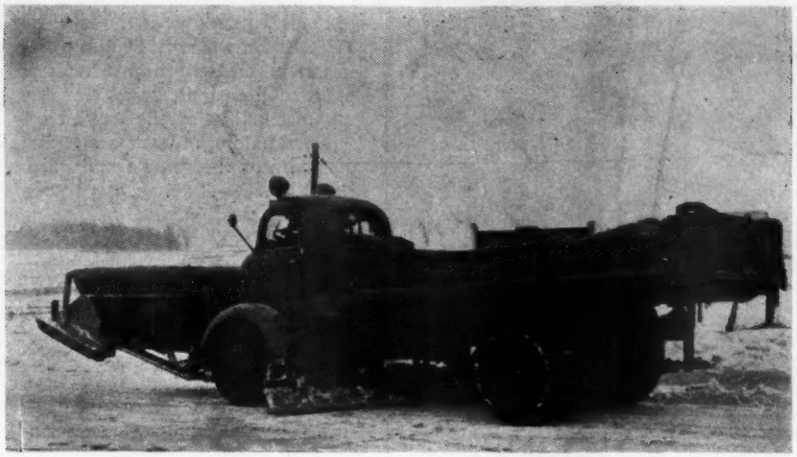
12. Improvements in Methods of Asphalt Subsealing of Concrete Pavements. By H. L. Cooper. Pp. 8-10, 13.
13. Highway Tree Maintenance. By E. S. Whitaker. Pp. 12-13, 21.



Snow plow-planer combination used in Wexford County, Mich.

Road Maintenance With Underbody Planers in Michigan

In Michigan excellent results have been obtained with gravel roads, due mainly to two factors: First, insistence that the gravel used in road construction contains about 10% clay to act as a binder. Second, the manner in which the roads were worked with the planers until the clay was thoroughly mixed with the pebble. It is this type of surface that Michigan counties endeavor to patrol consistently after each rain, and where long stretches of dry weather are encountered a 5-ton per mile application of calcium chloride has been found to improve the situation considerably.

Delta County, under the direction of Superintendent and Engineer J. T. Sharpensteen, fitted a fleet of six trucks with underbody planers. Delta's road system includes 784 miles, yet every mile of secondary road in the county received its share of attention from the maintenance fleet. Spring, summer and fall found all the feeder roads in this county ready to carry their respective traffic loads without delay or discomfort.

Many counties in the state, especially in the northern portion, use the planers in winter, too. Carl Munsen, Wexford County Superintendent, says: "Wexford County is located in a very hilly region. These hills pose a serious problem in the winter months, particularly for heavy tractor-trailer outfits. We find that by starting our patrolling at the first sign of snow we can keep our paved roads bare with undertruck scrapers. We like these units because of their speed and because they scrape right down to the road surface without damage to either the road or the blade. We use one-way plows to follow the planers and push the snow from the shoulder back off the right of way."

Some counties reverse this procedure and follow a V-type plow with a planer equipped truck. The planer removes the residual snow and slush ridden over by the plow. This effort to keep paved road surfaces completely free of snow and slush-ice has very probably prevented numerous accidents.

In addition to routine patrolling, the planers have been found to be adaptable to a variety of maintenance tasks. Experienced operators can perform grading with the units, providing an able ally in assisting secondary roads to retain their shape. Shoulder maintenance also falls within the planers' performance range, and improved drainage has followed their use on many Michigan byways.

A New Weapon to Kill Weeds

A powerful new chemical with the formidable name of 2, 4-dichlorophenoxyacetic acid, called 2, 4-D for short, is said to be the most effective weed killer yet devised. This substance is one of the most potent of a group of chemicals that

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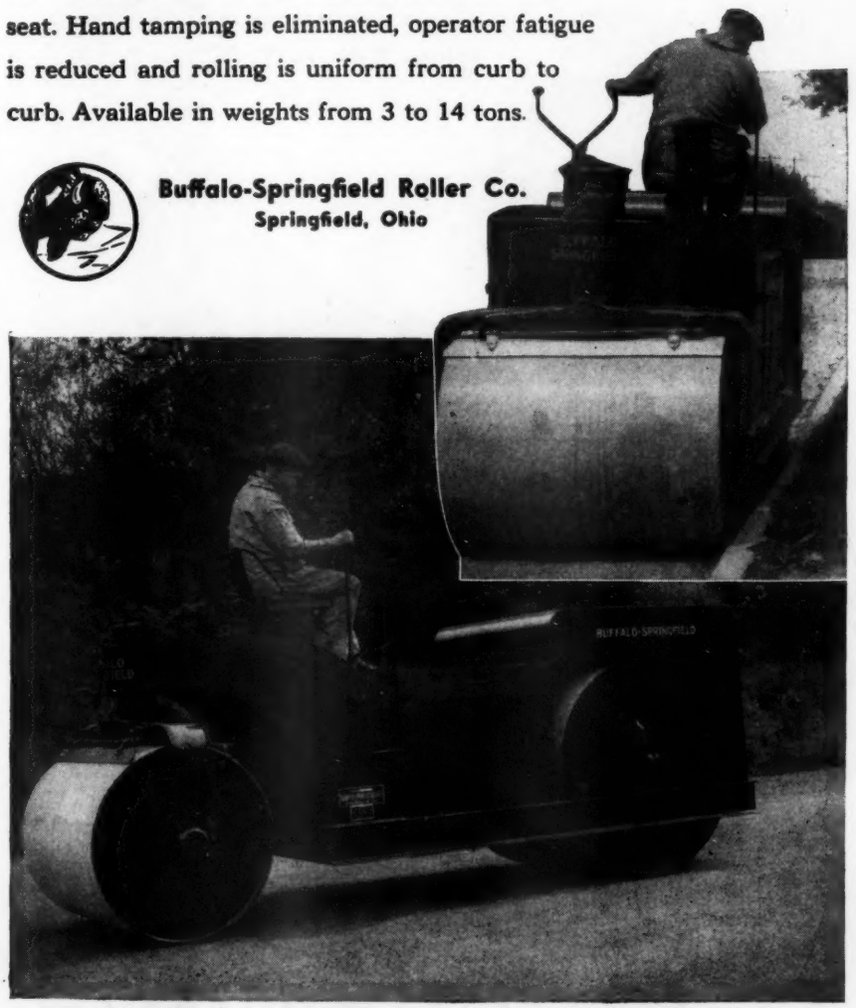

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GRADERS · ROLLERS

influence plant growth and behavior. Mixed with water in proper proportions, it enters the leaf and travels to other parts of the plant, destroying the growing mechanism of the weed.

Fortunately, bluegrass and most other members of the grass family are not injured by 2, 4-D spray. Bent grass is one exception and should not be sprayed. Some 100-odd common weeds, including narrow and broad leaved plantains, dandelion, bull thistle, burdock, nettle, wild carrot, hedge bindweed, cinquefoil and honeysuckle are usually killed with one application. Other hard-to-kill weeds with extensive underground root systems may need two or more applications before they succumb. Among these are Canada thistle, field bindweed, goldenrod, milkweed and poison ivy. Spray should be applied when plants are in an active growing condition. Agricultural chemists have found that 2, 4-D does its job better in the sun than in the shade.

Spray mixtures of 2, 4-D, as recommended with a number of formulations now on the market, are non-poisonous to human beings and domestic animals, as demonstrated in experiments.

This material has been developed by the Dow Chemical Co., Midland, Mich.

Edward S. Hopkins Receives Army Award

Lt. Col. Edward S. Hopkins, Sn.C., on June 10th was awarded the Army Commendation Ribbon by Maj. Gen. M. P. Eddy, Deputy Commander, Second Army, with the following citation: "For outstanding and meritorious service as Sanitary Engineer, Headquarters Third Service Command from January 1944 to December 1945. His superior technical knowledge and experience was exemplified in the highly successful supervision of water supply, sewage disposal, avoidance of epidemics through close control over all sanitary facilities and conditions throughout the command. His work in mosquito control was especially noteworthy. Successful control of sanitary matters and facilities contributed materially to the health of the command." Lt. Col. Hopkins has reverted to civilian life and returned to his former position as Filtration Engineer, Bureau of Water Supply, Baltimore, Md.

Bituplastic—A New Protective Coating

Wailes Dove-Hermiston Corp., Westfield, N. J., has developed a new cold-applied coating, Bituplastic, for the protection of concrete, masonry and metal structures against corrosion and deterioration. This is a black, irreversible dispersion which, when dry, forms a tenacious, waterproof film which does not revert to its original state. Adequate drying conditions are necessary, but drying time is short. Bituplastic can be applied successfully on damp surfaces. It contains no volatile solvents and is actually a fire retardent, being practically incombustible. It is also virtually tasteless and odorless. It can be applied

as a very thick film by brushing or with standard spray equipment; usual rate of application is 75 to 100 sq. ft. per gallon per coat. It will not flow or sag at any temperature up to 600°F, its disintegration point, nor does it alligator in direct sunlight.

"Dwarf" Orange Peel Bucket Solves Problems

Designed for operation inside a 12" diameter pipe and for digging wells, catch basins and small drainage ditches, an improved Hayward "Dwarf" orange peel bucket makes possible significant economies in removing all kinds of materials such as broken stone, boulders, old timber, metals and other substances found in "filled-in" ground. Details are given in bulletin No. 804, just published by The Hayward Company, 50 Church Street, New York 7, N. Y. This bulletin will prove helpful to contractors, sand and gravel operators, and others who are seeking an effective means of removing materials from the inside of pipes or cylinders from depths varying from surface level to 75 ft. or more. It contains interesting illustrations showing typical applications as well as a valuable chart of bucket capacities, weights and dimensions.

Fluorine Now Available on Limited Scale

Fluorine, the most chemically active element known, has been put on the market for the first time by the Pennsylvania Salt Manufacturing Company, it was announced recently. The element, a gas, is so active that it defied isolation for 73 years after its discovery 133 years ago and was nothing more than a laboratory curiosity until the recent war. Fluorine now is available in steel pressure cylinders on a limited commercial basis for experimental use by manufacturers and researchers.

Scientists foresee a whole new field of chemistry in the development of fluorine compounds — developments which may mean improvement in everyday life in everything from wonder insecticides and simplified home heating and refrigeration to insulation for electrical voltages now not possible.

A New Sharp Indicator for Acid-Alkalinity Control

This is a sharp end-point indicator which changes from green on the alkaline side to an intermediate gray and to a definite purple on the acid side. One drop of N/10 acid will carry 25 ml. of sodium bicarbonate solution from green to the warning gray color. A second drop will bring the endpoint. For titrating a 100 ml. sample, 4 or 5 drops of indicator are normally required. This indicator is claimed to be stable, to contain no volatiles, and to be unaffected by organic matter or phosphates in solution. Write TruTest Laboratories, Inc., 261 S. Third St., Philadelphia 6, Pa.

Which HELTZEL FORM FEATURE DO YOU PREFER?

22 Adjustable Lateral Braces and Anchor Stakes for use on rigid or flexible radius forms hold top of form in positive alignment.

26 No loose parts or clamps. Secure the face form to the division plate, slide the locks home and start to pour.

27 Face forms are quickly removed after the concrete has taken its initial set, by disengaging the lock. Skeleton division plates are provided with the same arrangement.

29 A sleeve welded on one end of the rail over which the adjoining rail fits, makes an absolutely tight even joint.

31 Round stakes securely locked to the form by the wedge key permit the form to be suspended entirely independent of the subgrade. Indispensable when subgrade conditions are not uniform.

You buy Heltzel Steel Forms once. They stay in service for 20 years or more and each job you set is as uniform as the ones before. The low cost of equipment per year of service plus benefits of faster work with the use of steel forms, nets substantial savings and more business.

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(Type of Construction usually engaged in)

HELTZEL STEEL FORM & IRON CO.
WARREN, OHIO · U. S. A.

Winter Protection for Cincinnati's Cliff Dwellers

(Continued from page 30)

water out into the center of the manhole, melting the snow and keeping the sewer from clogging.

While snow provides its own headaches, of course, it does not create the worst problems for us. Our biggest difficulties stem from wide variations in temperature in this part of the country and from the many freezing rain storms we have. The 1944-1945 season was the worst in the history of the department, with 45 straight days of sleet. We worked 7 days a week around-the-clock during that period.

Usually we get about three days of rain at subfreezing level and then the temperature shoots up while we work quickly to get the ice cleared away. By the time we have finished, the whole cycle is apt to begin again. Since plows and scrapers are ineffective in weather of this sort, we rely heavily on rock salt and some abrasives to keep our traffic lanes open and safe for our 500,000 local residents and the many more commuters from Kentucky.

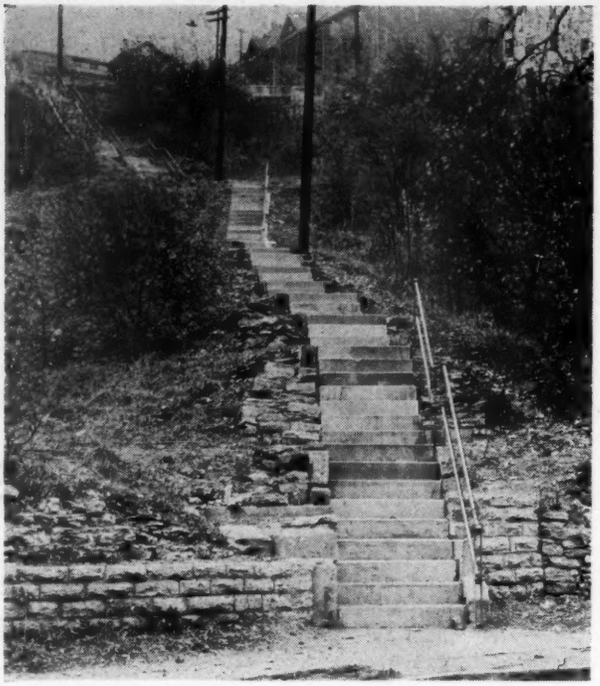
Generally our salt trucks go out early in a storm and distribute their loads of rock salt on all primary and secondary streets and other perilous areas in their respective districts. The rock salt bores down quickly through ice or compacted snow, breaks them up and keeps them from freezing to the pavement.

From start to finish, every step in our winter maintenance program has been carefully planned in anticipation of any emergency that may arise. During the winter season all personnel are kept alert when bad storms are brewing. Men at our various garages and yards check in with the dispatcher's office if storm conditions seem to be developing. The dispatcher maintains close contact with the airport weather bureau, bus terminal dispatcher, railroad dispatcher and U. S. Weather Bureau to get all available information on the type of storm and the speed with which it is crossing the country.

Even after a storm hits, the dispatcher continues to keep a close tab on the weather by maintaining an hourly check with the Weather Bureau. Usually, when a snowstorm is indicated, the railroad and bus dispatchers can predict the precise time the snow will begin to fall. Such know-how is of immense value to us, for we can mobilize our force and be ready to go into action while the storm is still passing through the neighboring cities.

If the storm condition is light and purely local in scope, the dispatcher assigns the department's two radio-equipped emergency trucks to 24 hr. patrol duty. As the storm develops, the trucks report to the control office on the condition of all listed routes in the various zones. The Assistant Superintendent, C. Heidschuch, who is in charge of all slippery street work, notifies section supervisors who get their crews out on the job. Power bucket loaders are used in loading the 60 trucks and 13 rock salt spreaders. The driver and a helper move to their assigned areas, spread their load and return to the salt and abrasive storage yards for refilling.

Step and walk crews follow a regular step route. One and a half-ton pick-up trucks filled with straight rock salt travel from one street level to the other while the scoop and bucket brigade distribute the salt up and down each section of steps and walks. For the convenience and safety of residents living



Steps like these are treated with rock salt after every storm.

along secondary streets with steep grades, we have placed bright yellow-painted 50 gal. drums of rock salt and abrasives in easily accessible locations. Homeowners, motorists and pedestrians are invited to help themselves. The favorable comment received to date for installing this service is the best indication of its value.

All our operations are coordinated with that of the Cincinnati Street Railway Company, which provides valuable assistance by servicing surface transit lines, bus routes, loading platforms, trolley and bus stops. Their method of caring for their routes is similar to ours and includes the same techniques involving extensive use of rock salt to secure safety for their passengers.

Another special service we have developed in cooperation with the Cincinnati Recreation Commission is in assigning designated blocks as coasting streets. Each year a list is made up by the Commission and arranged by district. Coasting facilities are provided by our method of treating one-half of the street so traffic can move safely while the other half is blocked off and left untreated so that the kids can coast in security. In any case, the base of the grade of all coasting areas is heavily treated with abrasives to prevent sleds from getting involved in traffic lanes.

Water Diviners Still Operate in England

In a paper before the English "Institution of Highway Engineers," B. F. J. Bradbeer, Assistant County Surveyor of East Sussex, speaking of highway embankment, said: "Much time can be saved in the spotting of boreholes for the location of water tables and tracing of faults and springs if the site is first quartered by an experienced water diviner," a method which, he adds, "though lacking in the confirmation of science, is in practice accepted without reserve by those who have made use of it." It may, in that regard, be pointed out that some scientific investigators

believe it to be possible that the hazel twig and the nervous system of the diviner may constitute a "receiving set which functions much as do their own delicate instruments used in locating underground water and metals."

Damages to Oyster Beds by Sewage

It is an established principle by the weight of authority in most states that municipalities have the right to discharge sewage into tidal waters. Any resulting injuries due to the dissipation of bacteria through the waters in their natural movement are *damnum abseque injuria* (damage without legal remedy), although the doctrine is not universally accepted. And its limitations are shown where there is actual destruction of or injury to oyster beds by the deposit upon them of sewage filth or sludge, or other visible or offensive conditions.

Where a municipality was not directed by statute to lay any particular sewer, but was given power to do so by a special act of the legislature, the municipality was held to have no direct sanction to lay its outfall sewage pipe line in a proprietor's oyster beds, and was bound to use such means as would not unnecessarily injure them, and the plaintiff was entitled to compensation for the damage done. The plaintiff's obligation to minimize his damage by removal of the oysters was held met by a reasonable effort to remove the oysters after notice, and the removal of two-thirds of the bed. Loveloy v. Town of Darien, 131 Conn. 535, 41 A 2d 98.

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More Ford Trucks in Use Today Than Any Other Make!

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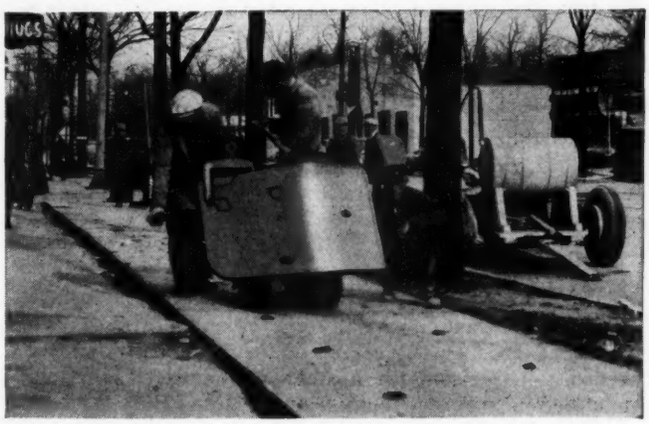

CUT MAINTENANCE COSTS 75%

Concrete slab maintenance costs can be reduced as much as 75% by the Koehring Mud-Jack Method. The Mud-Jack raises sunken concrete walks, curbs and gutters, driveways, streets, and airport runways, eliminating reconstruction costs. Write for the free illustrated handbook "How to Detect and Correct Pavement Slab Pumping."

KOEHRING COMPANY
Milwaukee, Wisconsin

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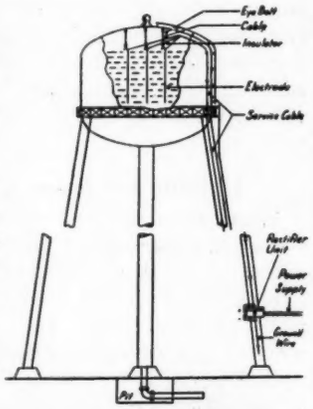
Permanent PROTECTION against under-water RUST

The Electro Rust-Proofing Cathodic System simply stops the electrolytic action which causes rust on submerged metal. It therefore stops rusting—instantly, permanently, economically. Kills the greatest cause of deterioration. Eliminates forever the costliest item of maintenance—draining, scraping, painting. Usually installed for about the cost of one paint job; operates year in and year out for a small fraction of ordinary painting cost. Used by thousands of municipalities and industries in water tanks, standpipes, flocculators, deep wells, and other water-handling equipment. Engineered to each installation. Advocated by independent authorities. Write for details, proof of performance, list of users.



ELECTRO RUST-PROOFING Corporation
DAYTON 10, OHIO, U. S. A.

LEGAL DECISIONS

City Not Liable for Unauthorized Use of Material

A city, engaged in laying a sewer in a street, had piled up boards and beams at the end of a day's work, and children used a beam upon a wooden horse for a seesaw. They lost control of the beam, permitted its end to fall across the sidewalk and to strike and break the leg of a passing child. In an action for damages it was claimed that (a) there was a defect in the highway and (b) a nuisance in the public street was permitted by the city.

The conduct of the children, it was held, did not constitute a defect in the highway, for which a municipality could be held liable under the statute relating thereto. Even if the seesaw should be held a defect the plaintiff still could not recover, because the wrongful act of the children in using the city's property as a seesaw was either the sole cause, or the contributing cause.

The erection and use of the seesaw by the children did not constitute any permanent and continuing condition of the highway and so a nuisance for which the city could be held liable. Caissie v. City of Cambridge, Massachusetts Supreme Court, 58 N. E. 2d 169.

Engineer's Control for an Indefinite Future is Void

The fact that a city had statutory authority to construct a waterworks system and to contract wih regard thereto did not mean that it could give someone the exclusive right to serve it as an engineer in the event it should first become financially able and should then decide to build such a system at some wholly indefinite and undetermined time in the future. Such a contract is void, not because it is against public policy, but rather because it is beyond the power of the municipality to make. The case would be different if the city, when the contract was made, had in its treasury bonds from which it was contemplated by the parties that the engineer was to be paid his commission.

When he dealt with the city, the engineer would be presumed to know the extent of its powers, and if he proceeded under the contract, he did so charged with knowledge that the city might elect not to perform it, and that want of power to make the contract authorized the city to disregard it. An action was brought by the engineer for breach of a contract to pay plaintiff for engineering services in preparing plans and specifications for the construction of a water system. City of Big Spring v. Ward. Texas Commission of Appeals, 169 S. W. 2d 151, reversing 161 S. W. 2d 821.

Liability for Sewer Improvement Bonds

When state statutes authorizing the issue of sewer assessment bonds limit the exercise by the city of such authority to those instances where property owners affected have elected to pay the cost of the improvements in installments, and, to that end, have executed waivers in conformity with the statute, there is no authority given to a city for the issuance of bonds equal to the unwaivered assessments of property owners. A city is not liable for the payment of improvement bonds except to the extent of moneys actually collected and accumulated by it from assessments made against property benefited. Reade v. Abe Rosenblum & Sons, Indiana Appellate Court, 58 N. E. 2d 376.

Standards and Practices for Highway Signs

(Continued from page 23)

crew for traffic using the same lane and another approximately one mile ahead facing traffic in the opposite lane. Each sign should be mounted on a tripod of sufficient height to provide a minimum of 18″ clearance above the ground and each should be equipped with a red flag. Signs used for maintenance operations carried on only during daylight need not be reflectorized. These signs should be moved at noon time to establish a new zone to cover the afternoon work. In locations where the alignment is variable, it may be advisable to move the signs more often, creating three or more repair zones during a single working day. All signs must be removed from the roadway at the close of the day's work. Protection of the crew and traffic operating in the immediate vicinity of the job should be provided by a flagman.

Road repairs of a semi-permanent nature, which require that portions of traffic lanes be barricaded for periods longer than one day, should be protected by a series of signs essentially as shown in Fig. 5. In each of these cases a reflectorized ROAD REPAIRS AHEAD sign should be placed at a minimum of 800 ft. in advance of the first barricade. The other signs shown shall be distributed at the approximate spacing shown on the sketches.

Torches should be placed in front of all non-reflectorized signs in such position as to illuminate clearly the sign face in darkness. Torches should also be placed at each barricade and should be lighted before dusk.

Removing More Snow With Fewer Plows

(Continued from page 29)

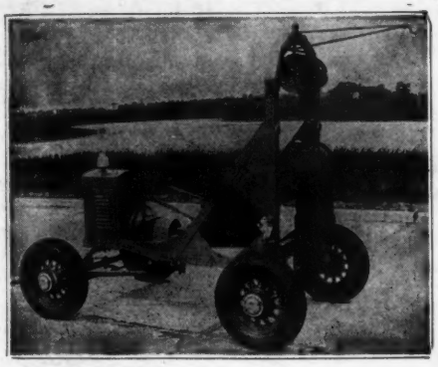
these, are being considered for allocation to this field.

Mobile units can be installed readily in trucks or cars. The illustration herewith shows one of the Brown County snow plowing units in which radio has been installed. According to RCA, mobile units require about half the floor space and one-fourth the cubic space of the average automobile trunk space. In trucks, they can be mounted in any convenient position. The loudspeaker is usually placed on the dash board or just beneath it, next to the heater; the handset phone is mounted nearby. The units are mounted on separate base or other attachment plates, which are bolted in place, with the transmitter and receiver attached by a single-turn fastener. A power cable connection must be made to the battery and a control cable installed between the transmitter and receiver and the dash board control unit.

Headquarters installations are generally similar to mobile units. Since there are fewer limitations on fixed installations there are more possibilities for varying arrangements of equipment. The same basic elements are needed but more powerful transmitters are often used and in some instances spare receivers and other auxiliary equipment are provided.

For any station installation it is usually necessary to mount the antenna at an elevated point. This may be done by mounting it on a short pole on top of a building or by erecting a tower or pipe mast of sufficient height.

KEEP THOSE SEWERS OPEN!



Sewers clogged with sand, roots and other debris are a constant danger to public health and safety. New installations rapidly lose their efficiency due to sand seepage.

You positively can keep the sewers of your city open with an OK Champion—the cleaner that does the entire job from street level. Dig-ups practically a thing of the past.

Three Distinctive Models Available. Write Now for Literature.

CHAMPION CORPORATION

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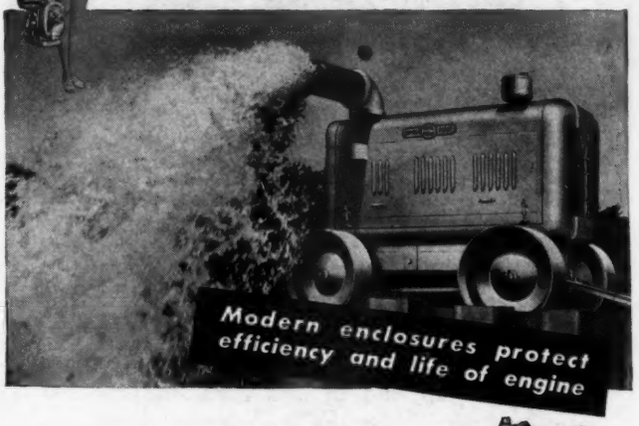
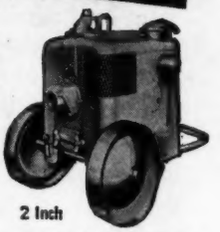
JAEGER "Sure Prime" is a better pump—*inside and out*



Contractors buy more Jaeger "Sure Primes" than any other pump because they're better engineered, more amply powered, conservatively rated, and fully enclosed from weather to keep them clean, dry, quick-starting and smooth running for extra thousands of hours . . . Sizes 1½ to 10". Ask for Catalog P-45.



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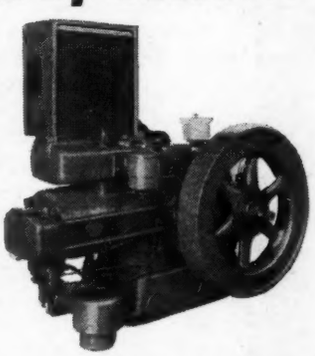

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Weather-proof: push rods, valve levers, etc., fully encased. Buyer has option of carburetors—for operation on either kerosene, gasoline, or natural gas. Counter-balanced crankshaft of heat-treated forged steel, *held permanently on center* by precision roller bearings. Hot spark at hand crank speed assures starting ease. Rated 5 to 10 H. P. at 450 to 900 R.P.M. Write—*now*.

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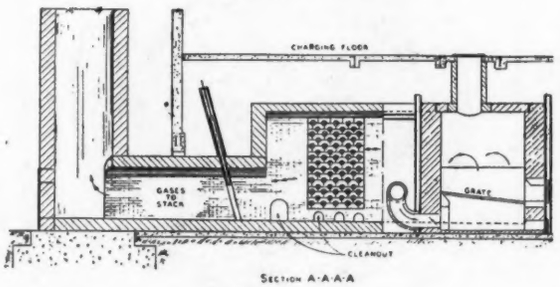

SECTION A-A-A-A

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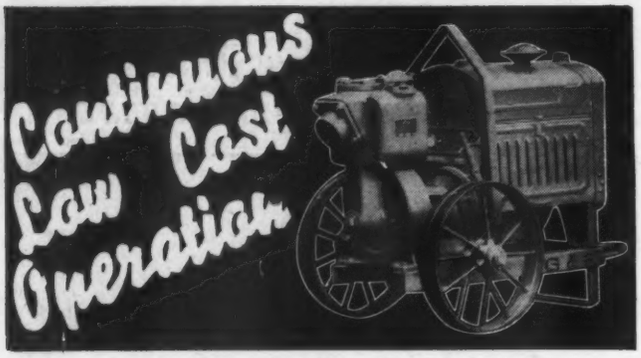

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Your nearest Gorman-Rupp Distributor will be glad to put one of these pumps on your next job and let it talk for itself. Write for further details.

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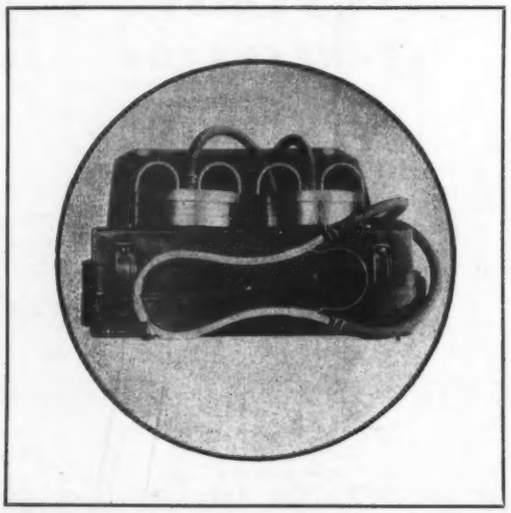
A "Bull's Eye" every time



When hunting leaks, you need not be an expert marksman if you use the A/H LEAK LOCATOR. It will lead you to that underground leak in a jiffy. No hit-and-miss excavating, no unnecessary resurfacing of the street.

Price complete with carrying case and strap: $75.00

Send for circular PW-6 covering complete line of A/H Water Works instruments.

ALLEN-HOWE ELECTRONICS CORP.

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Pipe Locators	Dipping Needles	Leak Locators	Pipe Phones
$100.00	$17.50	$75.00	$3.70

When writing, we will appreciate your mentioning PUBLIC WORKS

The difficulties of effective contact with men operating snow plows on extended highway systems are similar to those of field communications at a battle-front. The value of radio in these circumstances was clearly illustrated during the war, and should not be forgotten when dealing with peacetime emergencies. With two-way radios linking headquarters to snow plows busy clearing blocked roads, the superintendent need never guess at the progress of his equipment. He receives reports and directs operations without the delay involved where drivers must leave their job to call the office. Work can go on in rural areas where few telephones are available without added handicap.

New radio installations are soon justified by the benefits they provide. Instead of heavy equipment blindly patrolling all roads where drifts are expected, lighter and faster plows initially cover the route. The driver notifies the dispatcher of drifts as they are encountered and then proceeds to skirt around them without a thought of bucking the deep snow. The dispatcher sends a rotary to the scene, and the drift is soon removed. The process continues—the lighter plow taking away the surface snow—the rotary plow delivering the knockout blow to stubborn drifts.

Only by the use of radio can a dispatcher coordinate the operation of all available equipment to greatest advantage. The resultant economy of time and mileage is soon reflected in reduced operating costs and a speedier opening of highways.

Throughout the year the highway supervisor will appreciate the advantage of two-way radio communication with maintenance crews working at distant points. As in winter snow removal jobs, quick reports can be made where unforeseen conditions are encountered and new instructions easily dispatched.

A Sewer Test for Tightness

(Continued from page 21)

the Y's after the inside of the bell was smeared with only enough bituminous seal material for it to stick and no bituminous material was filled in on top of the stopper. As result the Y stoppers were blown out when the test was made. The test clearly indicates what particular joints are not satisfactory and the contractor can make repairs before the trench is filled. By such a test, strict compliance with proper sewer construction specifications can be controlled.

Anything we can do to help make sewers tight I believe should be done. The infiltration record of most places in New Jersey is not a very envious one. Infiltration reduces the available capacity of sewers and treatment plants and if pumping is employed adds to the daily cost of handling sewage. Once infiltration exists, it is almost impossible to correct it; therefore, it is important that it be eliminated at the start.

There are certain fundamental requirements in making joints which may be listed as follows:

1. The bell and spigot must be clean and dry. 2. Jute packing yarn must be clean and have strands, free from tar, knots, dirt, etc. 3. Not more than two lengths of pipe may be joined on the ground before lowering into the trench. 4. Just enough jute shall be caulked in the joint to prevent the jointing compound from running away. 5. Plenty of approved jointing compound must be used—at least one and one half inches (1½") deep. 6. Jointing compound must be poured only when it is at proper temperature and consistency. 7. Good workmanship is most important.

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"is accurate . . . much more so than the hand samples we used to take"

"saved us employing another man when funds were tight anyway"

"lets us catch a sudden rise in bacterial count long before we'd have found it the old-fashioned way"

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News of People

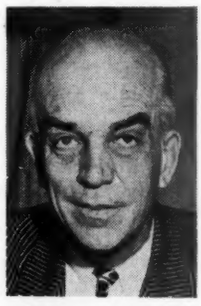
Rolland W. Simpson has joined the staff of Gilbert Associates, Inc. Consulting Engineers, Reading, Pa., New York, Philadelphia and Washington. During the war, Mr. Simpson was a civilian employee of the Corps of Engineers, engaged on a number of large projects.

Thomas S. Burns, formerly with the U. S. Engineers, and Col. Waldo I. Kenerson, recently released from active duty with the Corps of Engineers, have organized the consulting firm of Burns & Kenerson, 20 Kilby St., Boston, Mass. The field covered will include airfields, dams, flood control, foundations, hydroelectric developments, water supply, and other military and civil projects.

L. O. McLEAN
Of General Excavator Co.

Capt. Frank M. Williams has been made district engineer of the Clay Sewer Pipe Association in the state of Ohio and will have offices with the Ass'n. in Columbus. Mr. Williams was formerly with the Ohio Highway Dept.

John J. Palmer has been made Manager of the Newport News, Va., plant

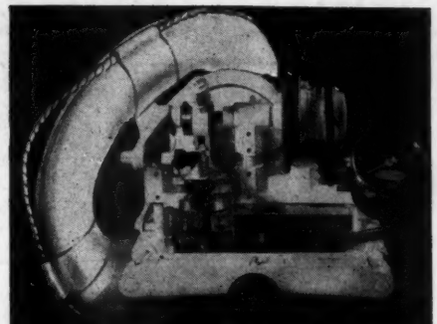


JOHN J. PALMER
New Manager of Gar Wood Newport News plant.

of Gar Wood Industries, which will make light road machinery, motor boats and truck tanks.

Col. Edward S. Hopkins, Sn. C., has returned to Baltimore, Md., to act as superintendent of water filtration there. Col. Hopkins spent more than 4 years on active duty.

Alfred N. Warwick, New York building contractor, has been elected president of the Moles, an organization of tunnel and heavy contraction men.



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For the Engineer's Library

Sizing and Selection of Grease Interceptors.—This is an 8-page booklet that shows how to select scientifically the proper size of grease interceptor based on (1) the quantity of waste water and (2) the expected quantity of grease. A pocket inside the first cover contains a special slide rule to aid in computing the sizes required. The booklet also describes the purpose and operation of the grease interceptor and recommends selection for standard installations. J. A. Zurn Mfg. Co., Erie, Pa.

Bitucote.—A well prepared, but general, 8-page booklet describing the uses of Bitucote, and the places where it should be used. Bitucote Products Co., Engrg. Dept., 1411 Central Industrial Drive, St. Louis 10, Mo.

Refuse Collectors.—A 4-page folder on the "Refuse Getter" lists advantages of hip-height loading, speed in collection, attractive appearance, and tightness. 8½ and 13 cu. yd. sizes. Also a 4-page folder on the "Compactor," which is essentially the same unit as above, but so constructed that refuse can be compacted by 12,000 lbs, pressure within the body, permitting much larger loads to be hauled. Elgin Corp., 501 Fifth Ave., N. Y. 17, N. Y.

Valve controls for filters and softeners. Master valve control for gravity and large size pressure filters or zeolite softeners is described in a booklet issued by The Permutit Company, 330 West 42nd Street, New York 18, N. Y. Automtic control, made possible through the use of a master valve, regulates rate of flow, prevents waste of water in the operation of backwashing and rinsing and maintains the zeolite or sand bed in clean, active condition. This installation is adapted to municipal water works, isolated railroad water stations or large water treatment plants where one man does not have sufficient time to handle all operations with manual valve control.

Asbestos-Cement Pipe.—A 27-page booklet by Keasbey & Mattison Co., Ambler, Pa., which covers handling trenching, joining, couplings, laying curved lines, cutting pipe in the field, making connections to cast iron, providing for future cut-in connections, thrust blocking, service connections, backfilling and testing. Practical and valuable.

Wire-Stringing. — Clear and simple instructions for wire-stretching, and stringing are provided in a new bulletin just issued by W. C. Dillon & Co., Inc., 5410 W. Harrison St., Chicago 44, Ill. The bulletin is amply illustrated with diagrams, and provides engineering information that anybody can use, for security, efficiency and saving. Copies of the bulletin may be had without charge, by addressing W. C. Dillon & Co., manufacturers of the Dillon Dynamometer.

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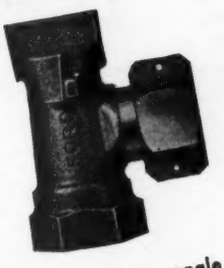
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PUBLIC WORKS Equipment News

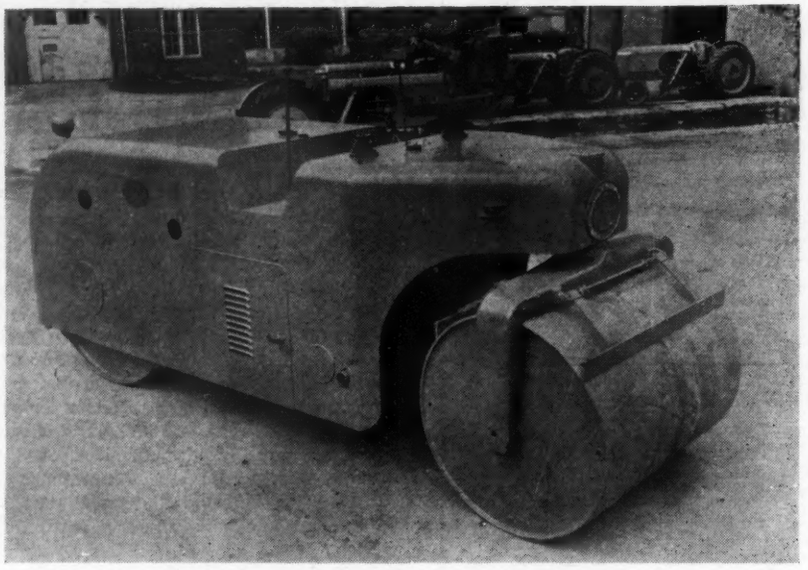
New Huber 5 to 8-Ton Variable Weight Tandem Roller

Huber Mfg. Co., Marion, O., has announced a new 5 to 8-ton variable weight tandem roller with a fluid coupling which greatly improves the performance of the roller, as well as prolonging the life of its entire gear train assembly, including all bearings, shafts and mountings.

Huber's new tandem is powered with a Hercules six cylinder gasoline engine. Low speed is 1.95 m.p.h. and high speed is 3.62 m.p.h. The overall dimensions are: Length 173″; width 63″; height 85″; height to top of water tank, 63″; wheelbase 120″; and ground clearance, 10″.

The compression roll has a diameter of 52″ and a width of 50″. The tandem's steering roll has a diameter of 40″ and a width of 50″. The total weight with ballast, is 16,100 pounds.

In addition to many other new features, this Huber also includes the original simplified and now improved dual operating control system, with finger tip operation.



New Huber Variable Weight Tandem Roller.

Automatic Steady Voltage in Witte Generators

The Witte Engine Works, Kansas City, Mo., has introduced a revolutionary constant voltage generator on 7.5 and 10 KVA "dieselectric" plants. No rheostat is required, nor does the new Witte generator use a moving or external operating instrument of any kind. The regulating circuit is built into the generator; load wires connect directly to the built-in circuit breaker on the generator. Voltage can be maintained within plus or minus 2% from no-load to full-load, with any power factor and up to full capacity. Since regulation does not depend on relatively slow-moving mechanical devices, but is accomplished electrically, lag or overrun in regulation is eliminated and voltage output held constant. This control requires no adjustment or other attention, as it is entirely automatic and should operate without care or attention year after year.

Todd Insecticidal Fog Machine

Last July, the first attempt to free a beach of mosquitoes and other nuisance insects was made at Jones Beach, New York, through the use of an artificial fog generating machine, developed by the Combustion Equipment Division of Todd Shipyards Corporation. "Tifa" (Todd Insecticidal Fog Applicator), dispersed a wide-spreading fog over large areas along the beach and killed enormous numbers of insect pests that had plagued the holiday visitors. Since that time, in tests covering more than a year, the fog machine which carries insecticides such as DDT, has been put in production.

The machine can disperse any insecticide (or fungicide or weed-killer) that can be dissolved, suspended or emulsified in oil, water or a like carrier, and the size of the particle in the fog can be controlled through the full range from smoke up to a spray. This particular model of Tifa, which can be easily operated by one man, is powered by a popular standard make of small gasoline engine. The size of the fog particles is controlled by setting two valves; one governs the pressure of the flow of the insecticidal fluid into the machine, and the other controls the size of the opening through which the insecticidal fluid passes into the end of the nozzle and meets the blast of heated air. TIFA uses no boiler, no coils, no water to make steam.

The Todd Insecticidal Fog Applicator in action.

Gar Wood Industries

The former Bendix plant in Wayne, Mich., has been purchased by Gar Wood Industries from the War Assets Administration. All Detroit operations, except the body plant, will be transferred, so that hoists, cranes, appurtenances for bulldozers and scrapers and similar items will be made at Wayne.

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1. LeRoi Portable compressors in sizes from 60 to 500 c.f.m., gasoline or Diesel powered on mountings to fit your special needs. Same manufacturer makes both compressor and engine. Complete bulletin. Write LeRoi Company, 1770 So. 68th St., Milwaukee 14, Wis.

2. Jaeger air compressors, made in sizes 60 to 500 cu. ft.; trailer, truck, tractor and stationary mounted, gas, Diesel and electric power. Catalog and data. The Jaeger Machine Co., 400 Dublin Av., Columbus 16, O.

Resurfacing Plants

15. Portable Bituminous Mixers in 6 to 14 ft. sizes for resurfacing and maintenance. Issued by The Jaeger Machine Co., 400 Dublin Ave., Columbus 16, Ohio.

16. Moto-paver is a new type self-contained travelling asphalt plant having a capacity of 100 to 120 tons per hour. A novel spreading and laying device permits quick change to various road widths and crown conditions and thicknesses. Write Hetherington & Berner, 729 Kentucky Ave., Indianapolis 7, Ind. for Bulletin MP46 which gives full descriptions and specifications.

Concrete, Early Strength

38. 64-page manual tells how to speed concreting, to secure high early strength and greater workability at temperatures either below or above freezing. 60 photos, charts, graphs and tables. Calcium Chloride Assn., Penobscot Building, Detroit 26, Mich.

Concrete, More Durable

50. How cement dispersion assures improved concrete with impressive economies in initial construction costs and maintenance costs. Manual from The Master Builders Co., 7016 Euclid Ave., Cleveland 3, Ohio.

Drainage Products

70. Standard corrugated pipe, perforated pipe and MULTI-PLATE pipe and arches — for culverts, sewers, subdrains, cattlepasses and other uses. 48-page booklet, No. 12. Armco Drainage Products Association, Middletown, Ohio.

72. New data on clay pipe is contained in literature offered by National Clay Pipe Manufacturers Inc. Address them at 111 W. Washington St., Chicago 2, Ill.

Forms, Curb and Gutter

78. Curb and Gutter and Sidewalk Forms, including battered face curb form especially for modern traffic conditions. Heltzel Steel Form & Iron Co., Warren, O., will send booklets on request.

Generators

80. Two portable generators, one for AC and the other for DC current are described in new bulletin issued by Homelite Corp., Port Chester, N. Y. Commonly used for operating electrical equipment in planes, tanks and trucks, or to charge batteries or to supplement batteries for starting main engines, etc.

Graders, Patrol

98. The Austin-Western 99M Power Grader with its powerful all wheel drive handles difficult jobs with economy and efficiency; and does better work on grading, ditching, scarifying, snow ploughing, loading, mixing, bulldozing, shoulder trenching and backsloping. Write for Bulletin 1946. Austin-Western Co., Aurora, Ill.

Joints, Expansion

102. Para-Plastic hot-poured rubber joint sealing compounds and Asphalt, Fibre, Cork, Cork-Rubber, Sponge Rubber and Waterstop expansion joints are described and illustrated. Write Servicised Products Corporation, 6051 W. 65th St., Chicago 38, for a copy.

Mud-Jack Method

107. How the Mud-Jack Method for raising concrete curb, gutter, walls and streets solves problems of that kind quickly and economically without the usual cost of time-consuming reconstruction activities—a new bulletin by Koehring Company, 3026 West Concordia Ave., Milwaukee 10, Wis.

Paving Breakers

110. Powerful self-contained gasoline hammers illustrated. Used as paving breakers and spike drivers. Easily portable, economical. Write Syntron Co., Box 220, Homer City, Pa.

Paving Materials, Bituminous

111. New "Tarvia Manual" is packed with useful data on how to build and maintain roads with Tarvia. Each step is illustrated with excellent action pictures, 64 pp. 103 illus. Write to The Barrett Div., 40 Rector St., New York 6. N. Y.

Pumps

117. New brochure by Gorman-Rupp Co., Mansfield, Ohio, illustrates and describes many of the pumps in their complete line. Covers heavy duty and standard duty self-priming centrifugals, jetting pumps, well point pumps, triplex road pumps and the lightweight pumps.

122. Pump Bulletin L-501 just out, gives latest illustrated information on Homelite gasoline engine driven portable pumps. Write Homelite Corp., Port Chester, N. Y.

Road Building and Maintenance

126. Two and Four Wheel Scrapers, Bulldozers, Tamping Rollers, Winches, Hoists and Repair Towers are subject of special bulletins issued by Gar Wood Industries, 7924 Riopelle St., Detroit 11, Mich.

128. Two powerful Galion motor graders designed to answer every requirement for more speed in road, airport, dam and housing construction work are fully described in a folder illustrated with many action pictures. Issued by Galion Iron Works & Mfg. Co., Galion, Ohio.

130. BG Maintainer, a powerful speedy, low-priced machine for light road maintenance. Write for folder, Huber Mfg. Co., Marion, Ohio.

Rollers

141. Three-Wheel and Tandem Rollers, 5 to 8-ton and 10 & 12 ton sizes: also variable weight tandem roller for new highway surfacing and old road conditioning. Huber Mfg. Co., Marion Ohio.

Soil Stabilization

150. "High-Service, Low Cost Roads" sets forth the principles and advantages of road surface stabilization with calcium chloride. Complete, interesting and well illustrated, 34 pages. Sent by Solvay Sales Corp., 40 Rector St., New York 6, N. Y.

152. Complete information dealing with Calcium Chloride Stabilized Roads. Contains many charts, tables and useful information. Write Columbia Chemical Div., Pittsburgh Plate Glass Co., Grant Bldg., Pittsburgh 19, Pa.

154. "Soil Stabilization with Tarvia"—An illustrated booklet describing the steps in the stabilization of roadway soil with Tarvia will be mailed on request by The Barrett Division, 40 Rector St., New York 6, N. Y.

Surface Consolidation and Maintenance

188. How sub-soils can be conditioned to resist softening and frost-action; how surfacing can be consolidated to provide smooth all-weather riding surfaces; how they can be maintained so as to prevent disintegration and gravel loss. Write the Calcium Chloride Association, Penobscot Bldg., Detroit 26, Mich., for Bulletin No. 29.

Tractors

190. International Diesel Tractors are described and many uses mentioned in 48-page catalog. Write International Harvester Co., 180 North Michigan Ave., Chicago 1, Ill.

192. Little Giant Tractor Sweepers for streets are described in illustrated bulletin. Especially designed to meet the needs of smaller cities and towns. Address: Little Giant Products, Inc., 1554 N. Adams St., Peoria 3, Ill.

Winches

200. 1-, 2-, 5-Ton Little Giant Hand Winches take the labor out of any heavy operation. Outstanding design and construction. Address: Little Giant Products, Inc., Peoria 3, Ill.

Maintenance Equipment

290. "Blacktop Road Maintenance and Construction Equipment" — Asphalt and tar kettles, flue type kettles, spray attachments, tool heaters, surface heaters, road brooms and rollers. This is modern and up-to-date equipment for blacktop airport and road construction and maintenance. Write for Catalog R. Littleford Bros., Inc., 452 East Pearl St., Cincinnati 2, Ohio.

Snow Fighting

Snow Plows

350. "Frink One-Way Sno-Plows" is a four page catalog illustrating and describing 5 models of One-Way Blade Type Sno-Plows for motor trucks from 1½ up to 8 tons capacity. Interchangeable with V Sno-Plow. Features, specifications and method of attaching. Frink Sno-Plows, Inc., Clayton, 1000 Islands, N. Y.

Ice Control

355. Cinder spreaders efficient at sub-zero temperatures are described in new catalog just out. Gives details special features, various capacities. Address Baughman Mfg. Co., Inc., Jerseyville, Ill.

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Air Release Valves

357. Automatic Air Release Valves for water, sewage and industrial uses are described and illustrated in new catalog issued by Simplex Valve & Meter Co., 6750 Upland St., Philadelphia 42, Pa.

Analysis of Water

360. "Methods of Analyzing Water for Municipal and Industrial Use" is an excellent 94 page booklet with many useful tables and formulas. Sent on request by Solvay Sales Corp., 40 Rector St., New York 6, N. Y.

Activation and Aeration

367. A valuable booklet on porous diffuser plates and tubes for sewage treatment plants. Covers permeability, porosity, pore size and pressure loss data, with curves. Also information on installations, with sketches and pictures, specifications, methods of cleaning and studies in permeability, 20 pp. illustrated. Sent on request to Norton Company, Worcester 6, Mass.

Bodies, Refuse

375. Gar Wood special bodies for sanitary refuse collection and for street sprinkling are illustrated and described in a new catalog issued by Gar Wood Industries. 7924 Riopelle St., Detroit, Mich.

Cleaning Sewers with Own Forces

385. A 20-page booklet describes and illustrates a full line of sewer cleaning equipment—Rods, Root Cutters, Buckets, Nozzles and Flushers. Write W. H. Stewart (Pioneer Mfr. since 1901), Jacksonville, Fla., or P. O. Box 767, Syracuse, N. Y.

386. 32-page illustrated booklet explains how a city can clean its sewers and culverts with its own forces using the up-to-date Flexible Sewer Rod equipment. Illustrates and describes all necessary equipment. Issued by Flexible Sewer Rod Equipment Co., 9059 Venice Boulevard, Los Angeles 34, Calif.

387. Literature illustrating how cities, towns and villages using OK Champion Sewer Cleaners are doing a complete sewer cleaning job from street level. Three sizes of machines available in addition to full line of sewer rods and accessories. Issued by Champion Corporation, 4752 Sheffield Avenue, Hammond, Indiana.

Cleaning Water Mains

388. Literature on Flexible method of cleaning water mains any size from 2" to 72", giving full details and list of nearest representatives in all parts of country. Address: Flexible Underground Pipe Cleaning Co., 9059 Venice Blvd., Los Angeles, Calif.

Corrosion Prevention, Water Tanks

389. For all water tank maintenance troubles, whether the need is for repairs, painting, welding, or cleaning, get latest literature of Chicago Tank and Bridge Co., 618 Empire Bldg., Rockford, Ill.

Corrosion Resistant Metal

390. "Preventing Corrosion of Steel Water Storage Tanks" is the subject of an interesting, illustrated bulletin issued by Electro Rust-Proofing Corp., Dayton 10, Ohio. Gives full description of Rustop System of prevention.

391. "Everdur Metal" is title of an 8-page illustrated booklet describing advantages of this corrosion-resisting alloy for sewage treatment equipment, reservoir, and waterworks service. The American Brass Company, 25 Broadway, New York.

Diesel Engines

392. 20-page catalog describes "Dieselectric" plants 3 to 10 KVA, and diesel engines from 4 to 12 H.P. These are easily transported and will produce reliable, low cost light and power anywhere. Write WITTE ENGINE WORKS, Division of Oil Well Supply Company, Kansas City 3, Mo.

394. "Blue Streak" engines for 425 and 495 hp are described in Bulletin No. S 329; also Bulletins SA 341 and 342 for small and medium power service. Write Climax Engineering Co., 111 W. Monroe St., Chicago, Ill.

Feeders, Chlorine, Ammonia and Chemical

398. There is a new 16-page illustrated booklet on accurate chemical feeding, describing the Var-I-Feeder, which every waterworks, sewage works and swimming pool man will want a copy of. For yours, just address: Chemical Feeders Division, Morse Boulger Destructor Co., 205 East 42nd St., New York 17.

399. Feeders of all types including Hypochlorinators, Reagent Feeders, Dry Chemical Feeders, Chlorinators and Ammoniators for feeding all of the usual chemicals used in sanitation practice—manufactured by Wallace & Tiernan Co., Newark 1, N. J.

400. For chlorinating water supplies, sewage plants, swimming pools and feeding practically any chemical used in sanitation treatment of water and sewage. Flow of water controls dosage of chemical; reagent feed is immediately adjustable. Starts and stops automatically. Literature from % Proportioneers, Inc. %, 96 Codding St., Providence 1, R. I.

401. Gravimetric Feeder, Loss-in-weight type, measures and feeds dry or liquid materials by weight. Illustrated bulletin. Omega Machine Co., Inc., 96 Codding St., Providence 1, R. I.

Fire Hydrants

406. Large, handsome, fully illustrated catalog covering full line of fire hydrants, valves, and kindred items. If you are in the market for them you will want this catalog. Address: Eddy Valve Co., Waterford, N. Y.

Flow Meters

409. The primary devices for flow measurement—the orifice, the pitot tube, the venturi meter and others—and the application to them of the Simplex meter are described in a useful 24-page booklet (No. 300). Simplex Valve and Meter Co., 6750 Upland St., Philadelphia 42, Pa.

Gas Holders

412. A 16-page bulletin gives detailed information on the development of corrosion—and how to combat it—in gas holders. A copy will be mailed on request to The Stacey Bros. Gas Construction Company, 5535 Vine St., Cincinnati 16, Ohio.

Gates, Valves, Hydrants

413. Gate, flap and check valves; floor stands and fittings. New catalog No. 34 gives detail information with dimensions for all types of new full line. M. & H. Valve & Fittings Co., Anniston, Ala.

Generating Sets, Diesel

420. Le Roi engine-generator units for operating on "no cost" sewage gas are fully described and illustrated in new bulletins now available. Address Le Roi Co., 1726 S. 68th St., Milwaukee 14, Wis.

422. New booklet describes Sheppard Diesel Generating Sets that make low cost electricity from cheap fuel and give dependable service in the hands of any average operator. Write R. H. Sheppard Co., 250 Middle St., Hanover, Pa.

Leak and Pipe Location

426. Leak Locators. Again available to waterworks superintendents, the Globe line of leak locators, dipping needles and pipe finders. Several leaflets describing the original Geophone leak locator, Little Wonder pipe phone, and the Magnetite Dipping Needle. Globe Phone Mfg. Corp., Reading, Mass.

427. For tracing buried pipes and finding hidden leaks get detail of Allen-Howe Leak Detectors, Pipe Locators, Dipping Needle and Pipe Phones. Write Allen-Howe Electronics Corp., 150 Main St., Peabody, Mass.

Manhole Covers and Inlets

429. Street, sewer and water castings in various styles, sizes and weights. Manhole covers, water meter covers, adjustable curb inlets, gutter crossing plates, valve and lamphole covers, ventilators, etc. Described in catalog issued by South Bend Foundry Co., Lafayette Boul, and Indiana Ave., South Bend 23, Ind.

Meter Setting and Testing

431. The most complete catalog we have seen on setting and testing equipment for water meters—exquisitely printed and illustrated 48-page booklet you should have a copy of. Ask Ford Meter Box Co., Wabash, Ind.

Meters, Venturi

432. New bulletin illustrates Builders Air Relay system for liquids containing suspended solids like sewage. Eliminates corrosion, clogged pipes, etc. "The Selection of Main Line Meters," a highly informative and useful presentation, describes forms of differential producers and quickly solves typical problems with the use of graphic charts. Write Builders-Providence, Inc., 9 Codding St., Providence 1, R. I.

Meters, Water

434. "Watchdog" water meters, made in standard capacities from 20 GPM up; frost-proof or split case in household sizes. All parts interchangeable with present models of same manufacturer. For bulletins, write Worthington-Gamon Meter Co., Harrison, N. J.

Pipe, Cast Iron

437. Cast iron pipe and fittings for water, gas, sewer and industrial service. Super-deLavaud centrifugally-cast and

pit-cast pipe. Bell-and-spigot, U. S. Joint, flanged or flexible joints can be furnished to suit requirements. Write U. S. Pipe and Foundry Co., Burlington, N. J.

438. "Cast Iron Pipe and Fittings" is a well illustrated 44 page catalog giving full specifications for their complete line of Sand Spun Centrifugal Pipe, Fire Hydrants, Gate Valves, Special Castings, etc. Will be sent promptly by R. D. Wood Co., Public Ledger Building, Independence Square, Philadelphia 5, Pa.

Pipe, Lock Joint

442. Lock Joint Reinforced Concrete Sewer Pipe, Pressure Pipe, Culvert Pipe, Centrifugal Pipe and Subaqueous Pipe is described and illustrated in bulletins available from Lock Joint Pipe Co., Ampere, N. J.

Pipe Pusher

444. One-man-operated Hydraulic Pipe Pusher pushes pipe through ground under streets, sidewalks, lawns and other obstacles. Pays for itself in man hours saved on first few jobs. For complete facts and prices, ask for booklet S-117, Greenlee Tool Co., 2042 Columbia Ave., Rockford, Ill.

Pipe, Transite

445. Two new illustrated booklets, "Transite Pressure Pipe" and "Transite Sewer Pipe" deal with methods of cutting costs of installation and maintenance of pipe lines and summarize advantages resulting from use of Transite pipes. Sent promptly by Johns-Manville Corp., 22 East 40th St., New York 16, N. Y.

Pipe Joints, Sewer

447. How to make a better sewer pipe joint of cement—tight, minimizing root intrusion, better alignment of joint. Permits making joints in water-bearing trenches. General instructions issued by L. A. Weston, Adams, Mass.

Pipe Joint Compounds

449. Full information on "Hydro-Tite" jointing compound for bell and spigot pipe, together with specifications, instructions; and illustrations both on it and "Fibrex" sanitary joint packing are contained in handsome 48-page booklet. Address: Hydraulic Development Corp., 50 Church St., New York.

450. The uses of Tegul-Mineralead for bell and spigot pipe and G-K Sewer joint compound are described in a 16-page illustrated booklet issued by Atlas Mineral Products Co., Mertztown, Pa. Includes useful tables for estimating quantities needed.

Pumps and Well Water Systems

454. Installation views and sectional scenes on Layne Vertical Centrifugal and Vertical Turbine Pumps fully illustrated and including useful engineering data section. Layne Shutter Screens for Gravel Wall Wells. Write for descriptive booklets. Advertising Dept., Layne & Bowler, Inc., Box 186, Hollywood Station, Memphis 8, Tenn.

455. Peerless deep well pumps in a variety of types, with oil or water lubrication and any power drive, to pump water from any depth. Write Peerless Pump Div., Food Machinery Corp., 301 W Ave. at 26th St., Los Angeles 31, Calif.

456. Oil lubricated turbine pumps with open impellers. Five types of heads available. Specifications and illustrations in new bulletin 6930M-2 issued by Fairbanks, Morse & Co., 600 So. Michigan Ave., Chicago 5, Ill.

457. Centrifugal Pumps of various designs—single-stage, double-suction, split casing; single-stage single-suction; two-stage opposed impeller; three-stage; high-pressure; fire pumps; close-coupled. A bulletin for each type. Peerless Pump Div., Food Machinery Corp., Quincy, Ill.

Rubbish Collection

459. For saving trucks, labor, and time in city rubbish collection get details of the new Dumpster-Kolector described in literature just published by Dempster Brothers, Inc., Knoxville 17, Tenn.

Screens

460. Be assured of uninterrupted, constant automatic removal of screenings. Folder 1587 tells how. Gives some of the outstanding advantages of "Straightline Bar Screens" (Vertical and inclined types). Link-Belt Co., 2045 W. Hunting Park Ave., Philadelphia 40, Pa.

Sludge Drying and Incineration

462. "Disposal of Community Refuse by Incineration" is a handsome 34-page booklet that discusses incineration from a commonsense standpoint. Illustrated by numerous photos of typical installations and includes diagrammatic outlines of various plant designs. Write Morse Boulger Destructor Co., 207-P East 42nd St., New York 17, N. Y.

463. Recuperator tubes made from Silicon Carbide and "Fireclay" Corebusters for maximum efficiency are described and illustrated in bulletin No. 11 issued by Fitch Recuperator Co., Plainfield National Bank Bldg., Plainfield, N. J.

Softening

467. Water Softening. The use of the Spaulding Precipitator to obtain maximum efficiency and economy in water softening is described in a technical booklet. Permutit Co., 330 W. 42nd St., New York 18, N. Y.

Sprinkling Filters

469. Design data on sprinkling filters of Separate Nozzle Field and Common Nozzle Field design as well as complete data on single and twin dosing tanks, and the various siphons used in them, for apportioning sewage to nozzles. Many time-saving charts and tables. Write Pacific Flush Tank Co., 4241 Ravenswood Ave., Chicago 13, Ill.

Swimming Pools

472. Data and complete information on swimming pool filters and recirculation plants; also on water filters and filtration equipment. For data, prices, plans, etc., write Roberts Filter Mfg. Co., 640 Columbia Ave., Darby, Pa.

Taste and Odor Control

474. Technical pub. No. 207 issued by Wallace & Tiernan Co., Inc., Newark 1, N. J., describes in detail taste and odor control of water with BREAK-POINT Chlorination. Sent free to any operator requesting it.

Treatment

480. Booklet No. 1642 on Link-Belt **Circuline Collectors contains** sanitary engineering data and design details. Catalog No. 1742 on Straightline Collectors, contains layout drawings, installation pictures and capacity tables. Address Link-Belt Co., 2045 West Hunting Park Ave., Philadelphia 40, Pa.

486. 28-page catalog describes and illustrates the Dorrco Hydro-Treator, a self-contained water treatment unit combining Flocculation, Sludge Thickening and Clarification. Reduces treatment time and lowers plant construction costs. The Dorr Co., 570 Lexington Ave., New York 22, N. Y.

488. "Packaged" Sewage Treatment Plants specifically developed for small communities — 100 to 3,000 population. Write for full description and actual operating data for this type of plant. Chicago Pump Co., 2438 Wolfram St., Chicago 18, Ill.

490. New bulletin fully describes and illustrates Hardinge sludge collectors for clarifiers, sludge concentration and skimming in both circular and rectangular tanks. Write Hardinge Company, Inc., York, Pa.

Water Treatment

496. "Use of copper sulphate in water treatment plants" contains valuable data on chemicals, dosage, etc. Ferri-floc Ferric Sulphate—a new, valuable booklet on coagulation for water and sewage treatment plants. Write Tennessee Corporation, Atlanta 1, Ga.

502. Alum for coagulation in both sewage and water plants is the subject of literature now available from General Chemical Company, 40 Rector St., New York 6, N. Y.

503. Get your illustrated booklet now on *Pittchlor*, a high test calcium hypochlorite, containing minimum 70% of available chlorine. Address, Pittsburgh Plate Glass Co., Columbia Chemical Div., 5th Ave. at Bellefield, Pittsburgh 13, Pa.

Water Service Devices

506. Data on anti-freeze outdoor drinking fountains, hydrants, street washers, etc., will be sent promptly on request to Murdock Mfg. & Supply Co., 426 Plum St., Cincinnati 2, Ohio.

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Written proposals for the above should be addressed to Borough of East Stroudsburg, East Stroudsburg, Pa.

Borough of East Stroudsburg, Pa.

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CONTRACT #1—INTAKE PIER AND PUMP STATION, including about 750 cubic yards of reinforced concrete in the intake pier, two deep well turbine type pumps, structural steel access bridge, piping, valves, controls, etc.

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Samuel Wright,
MAYOR.

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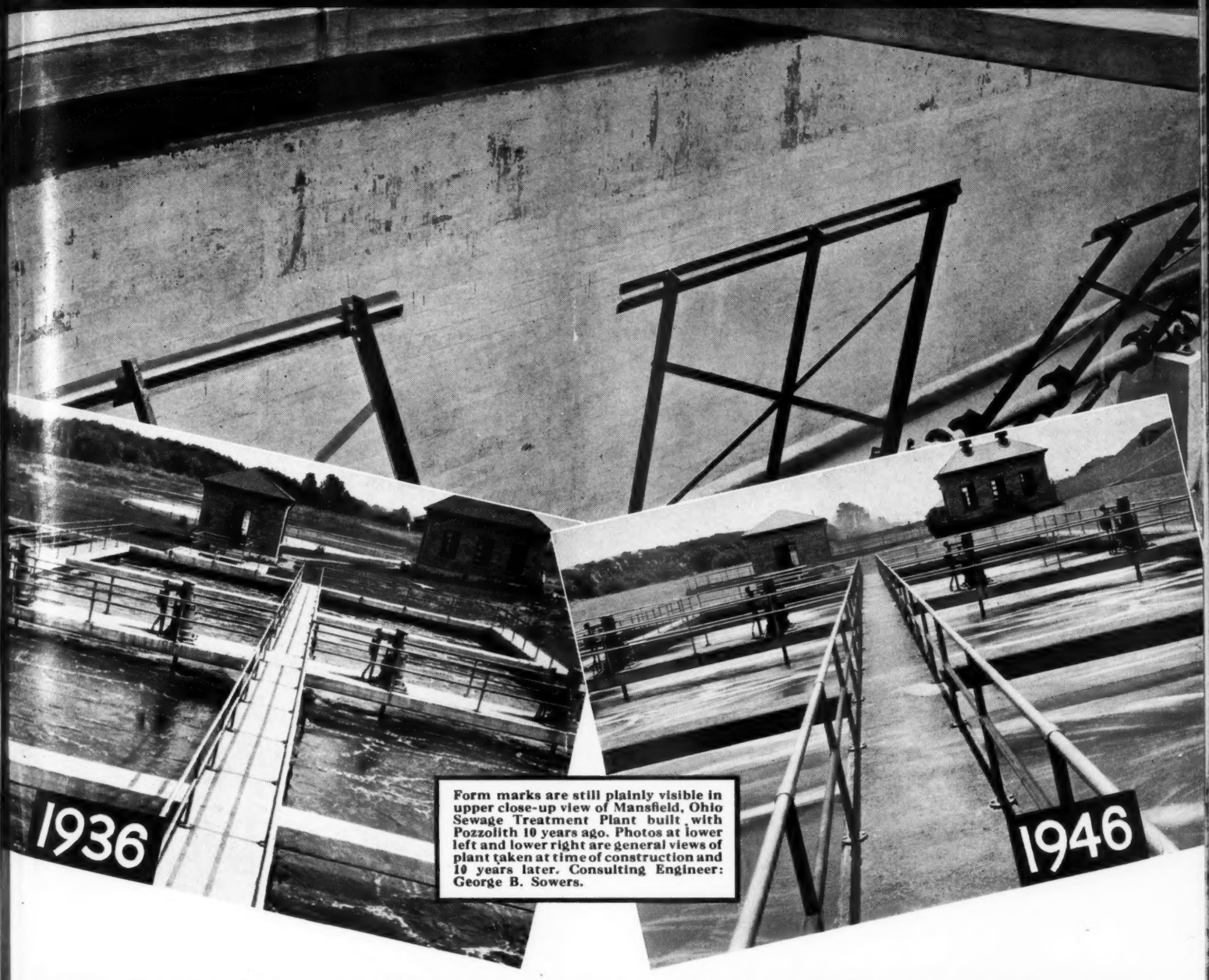

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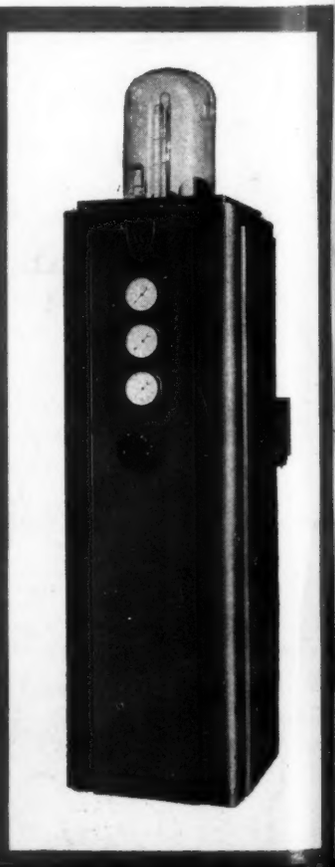

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